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ABSTRACT

In this study the effects of a particular type of teacher training material on the cognitions and behaviors of prospective teachers are investigated. The study is based on the assumption that theoretical knowledge that has emerged from research and theory development in education is useful for prospective teachers. The study is confined to that part of educational theory that directly pertains to the teaching-learning process. In chapters 2 to 4, the emphasis is on the theoretical framework of the study, while in chapters 5-7 the empirical investigation is reported. Chapter 8 is devoted to a discussion of some implications and limitations of the study. The main function of the theoretical chapters of the study is to present a line of reasoning embedded in and documented by relevant literature. In the final chapter, the main results of the study are briefly evaluated. A list of 287 references is included. (JD)

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INTERACTIVE COGNITIONS OF STUDENT-TEACHERS

AN INTERVENTION STUDY

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AN INTERVENTION STUDY

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Nijmegen, april 1989

Nico Verloop

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1. INTRODUCTION

1.1 Context of the study

1.1.1 Theory into practice

The relationship between theory and practice in the field of teacher education is a curious one. Despite the fact that a considerable amount of time is spent on subjects like educational psychology, didactics, etc., student-teachers in general remain rather skeptical about the usefulness of those matters for practice teaching.
Although this situation is not unique to this field and to some extent is the reality in all vocational education, in teacher education the magnitude of this problem is almost unparalleled.
This study is based on the assumption that theoretical knowledge that has emerged from research and theory development in education is, to some degree, useful for (prospective) teachers and that it is, consequently, necessary to bring these matters to the attention of the prospective teacher. It is further assumed that this should not be made dependent on all kinds of coincidences in, for example, practice teaching of a particular student-teacher in a particular probationary school, but that prospective teachers' introduction to educational theory should proceed in a systematic way.

In the present study we will confine ourselves to that part of educational theory that directly pertains to the teaching-learning process. In our view, in the presentation of this theory to the student-teacher the relationship between theory and the teaching-learning process should not only be explicated at the verbal-theoretical level, but also at the level of directly observable classroom behavior. In other words, what teachers actually do when they behave in accordance with a particular educational theory should be made visible.
This concerns both the instruction in educational theory in teacher education and the evaluation of it. The focus of evaluation should not be the verbal reproduction of educational theory, but the ability to interpret real-life classroom situations in terms of the pertinent educational theory. This requires the availability of materials in which educational theories have been 'made visible'. The most obvious way to devise such materials is in the form of video.
Of course it is impossible to cover 'educational theory' in its totality. In the context of this study two educational theories (pertaining to two teaching methods) were chosen. These two theories were illustrated in a

series of lesson episodes in two video-instruments. Detailed observation and interpretation of the lesson episodes in terms of the educational theories was required from the student-teachers viewing the videotapes. Thereby attention was focused on a number of central elements in each of the two theories.

1.1.2 Focus of the treatment

Enhancing student-teachers' interpretative abilities is seen as the most important goal of this type of instrument. The main purpose of these theory-based instruments is to help teachers acquire a repertoire of concepts for a more detailed perception, interpretation and understanding of classroom phenomena. Grasping the practical meaning of educational theories could provide tools for structuring the complex classroom situation. So, the primary goal of these instruments is of a cognitive nature: elements from educational theories should become part of student-teachers' cognitions. The focus of attention is the 'interactive cognitions' of student-teachers, i.e., the cognitions that are 'in operation' when they actually participate in the teaching-learning process. Defining the most important role of educational theory in this way deviates from the most important function as it is normally conceived for educational theory in teacher education, namely, providing prescriptions for the most desirable teaching behavior. Striving for influencing teachers' interactive cognitions places this study within the 'cognitive approach' in research on teaching. This approach, which has gained considerable influence since the mid-seventies, can in part be considered a reaction to the approach that was dominant up to then: the search for 'effective' teacher behaviors, i.e., teacher behaviors that are related to high pupil achievement. In our opinion, the unwarranted pretensions of those who prescribe effective teaching behaviors that have in the past emerged from this 'process-product' approach, have been an important cause of the skepticism of practicing teachers concerning the value of educational theory in general. We do not deny the value of process-product research or its potential for providing behavioral prescriptions, but consider this role to be subordinate to the role of educational theory as described in the beginning of this section.

1.1.3 Purpose of the investigation

The main purpose of the present investigation was to determine whether the instruments actually influenced student-teachers' cognitions. It had to be

determined whether elements from the two educational theories could be more frequently detected in the cognitions of student-teachers who worked through the video materials, compared to student-teachers who did not work through these materials. Of course all attention had to be centered on the cognitions of student-teachers at the moment they were actually teaching, in other words, on their 'interactive cognitions'.
Thus, comparisons had to be made between student-teachers who, besides studying written materials about the educational theories, had worked through the pertinent video materials and student-teachers who had been confronted with these theories in the traditional, verbal-theoretical way. Baseline data were obtained from a control group who got no specific instruction in these two educational theories.
Determining the effects of this kind of theory-based material has not been done before. It is true that in the past the effects of certain methods of teacher training have been measured. In the 'protocol materials' and in particular components of microteaching, some types of treatments were similar to the treatment of the present study. On the basis of these past investigations it might be expected that the treatment from the present study will, besides affecting student-teachers' interactive cognitions, to some degree also influence student-teachers' teaching behaviors. In the present study the latter type of effect was also determined.
It was furthermore investigated whether, at the level of the separate behaviors and cognitions, the relationship between cognition and behavior could be determined, and especially whether there were differences between the experimental groups in this respect.
It is clear that the presence of elements from educational theory in student-teachers' cognitions and behavior could be affected by more factors than type of treatment (video versus verbal-theoretical) alone. The most obvious variable concerns the student-teachers' ideas about educational theory in general. It is conceivable that those student-teachers who put a relatively higher value on the educational theory program are more inclined to use the theories in their own teaching, both cognitively and behaviorally. This made it necessary to investigate the student-teachers' appraisal of the educational theory program as an alternative explanation for possible experimental effects.

1.1.4 Relevance

The main relevance of this investigation concerns the field of teacher education.
In the first place it had to be determined whether it was possible to develop video materials for transmitting and evaluating educational theory

in such a way that a direct relationship to classroom practice is visible. If this is possible, this can be seen as an improvement compared to the customary, verbal methods for treating educational theory in teacher education. Ideally educational theory should be treated and evaluated in the context of real-life classroom situations. However, covering educational theory systematically in this way would require the permanent availability of great numbers of collaborating teachers who were proficient in the pertinent educational theories and in fact had the training of prospective teachers as their main task. For many reasons this is unrealistic. Having at one's disposal the type of instrument that was developed in the present study can be seen as a move in the right direction.

In the second place, and this is the main focus of this investigation, if it appeared to be possible to change student-teachers' interactive cognitions and their teaching behavior, this would be of value for teacher education. If cognitions could be influenced, these instruments could contribute to the professionalization of teaching, in the sense that they could lead to incorporating into student-teachers' cognitive structures elements from the 'body of knowledge' that is relevant for this profession and, thereby, become part of its 'basis for action'. This is generally considered an important characteristic of any 'professional' activity; it means that action is inspired by relevant theoretical knowledge, instead of dictated by prescriptions or common sense. If teaching behavior could be influenced by these instruments, this would mean that certain behavioral effects could also be brought about without specific behavioral training. This would not only be evidence in favor of the cognitively oriented explanations for effects of this kind of training that have been formulated up to now, but it also could have important practical consequences. Specific behavioral training (for instance, microteaching) requires substantial organizational measures. If behavioral effects could also be attained by the kind of instruments employed in this study, which are relatively simply to use, this would of course, for reasons of efficiency, be preferable. It is advisable to take advantage of the behavioral effects that can be attained by this type of instrument. This is particularly at issue in the first stages of a skill training sequence and does not imply that practice training will become unnecessary. Especially for integrating a skill into one's teaching repertoire, practice training will remain indispensable.

1.2 Composition of the study

In Chapters 2 to 4 the emphasis is on the theoretical framework of this

study, while in Chapters 5 to 7 the empirical investigation is reported. Chapter 8 is devoted to a discussion of some implications and limitations of this study.

As far as the theoretically oriented chapters are concerned, we do not claim to present a complete review of the literature that is available on this subject. Instead, the discussion of the literature is intended to ground, justify and explain the choices made in the empirical part of the study. An important consequence of this is the following: when the problems concerning the role of educational theory in teacher education (Chapter 2) or concerning the investigation of student-teachers' cognitions (Chapter 3 and 4) are treated, not only is relevant literature for every aspect or problem-field reported, but also our commentary on this, our ideas on this problem and the consequences for the procedure followed in the present investigation are discussed. So, the main function of the theoretical part of the study is to present a line of reasoning, embedded in and documented by relevant literature.

In Chapter 2 the problems concerning the role of educational theory in teacher education are raised. Five aspects that are relevant for the present study are treated.
In section 2.1 it is discussed to what degree one of the most essential characteristics of any profession, viz., working 'on a basis of relevant theoretical knowledge', applies to teaching and teacher education.
Section 2.2 goes into the question in which way the function one attributes to educational theory in teacher education is related to one's conception of teacher education in general.
Because the importance of theoretical aspects of teacher education are emphasized in this study, in section 2.3 we explain, as a matter of positioning, our ideas about two topics that explicitly concern the practical components of teaching and teacher education: practice teaching by student-teachers and craft knowledge of teachers. Critical remarks are made on the function practice teaching has at this moment.
Section 2.4 treats the question whether there is, principally, information from research and theory available, which could improve the quality of the teachers' functioning, apart from the teachers' readiness to use it.
In section 2.5 a fundamental dichotomy concerning the function of educational theory in teaching and teacher education is discussed: educational theory for providing prescriptions for effective teacher behavior (section 2.5.1) or educational theory for developing and enhancing teachers' interpretative abilities for a better understanding of classroom phenomena (section 2.5.2). These two functions are historically placed and illustrated by microteaching and protocol materials respectively. The first ap-

proach mainly aims at changing teacher behavior, while the second one is mainly concerned with changing teacher cognitions. It is pointed out that gradually also research done in the past on the effects of microteaching has contributed to the growing interest in the cognitive aspects of this type of training. Because in the present study the second approach, focused on changing teacher cognitions, is adhered to, our own ideas about this type of research are extensively discussed, particularly in section 2.5.2. Obviously the latter also holds for section 2.6, which treats a number of choices made in the present investigation that were not or insufficiently covered in the previous sections.

Trying to change student-teachers' cognitions of course raises the question how the effects of this kind of treatment on student-teachers' cognitions can be determined. Chapter 3 treats the research on teachers' cognitions. A distinction is made between teachers' thought processes that are directly related to specific actions (e.g., decision making, interactive cognitions), which are treated in section 3.1 and teachers' more permanent frames of reference in the more general sense, which are treated in section 3.2. From the second category, particularly teachers' implicit theories, which were also measured in the present investigation, are of interest here.
In section 3.3 the importance of investigating the relationship between cognition and action is briefly indicated.

In the present study student-teachers' interactive cognitions were measured by the stimulated recall method. This is the subject of Chapter 4.
In section 4.2 the place of stimulated recall within the larger picture of related techniques is considered and the validity of this technique in general is discussed.
Section 4.3 treats the use of stimulated recall in teacher thinking research and discusses a number of controversial matters that were raised in the literature.
In section 4.4 some applications of this technique in our type of study are dealt with.

In Chapter 5 the four main research questions are briefly discussed. A more detailed elaboration of these questions is postponed until the method of investigation has been treated.

Chapter 6 covers the method of investigation. First (section 6.1) the activities of the first two years of the research project are dealt with: the development of the two video-instruments that were used as treatment materials in this study. After the description of the sample and the design

of the study (section 6.2), the procedure that was followed in this investigation is described (section 6.3). In the final section (6.4) the research questions are again brought up. Those matters that were discussed at the general level in Chapter 5, are now, on the basis of the information presented in the preceding part of Chapter 6, treated in detail. Each of the main research questions is specified into a number of more specific ones.

Chapter 7 is the most voluminous chapter of the study. Each of the sections of this chapter is devoted to one of the main research questions, viz., the effects of the treatment on teacher cognitions (section 7.1), the effects of the treatment on teacher behavior (section 7.2), the relationship between cognition and behavior (section 7.3) and teachers' appraisal of educational theory (section 7.4); in section 7.5 a number of additional research questions is treated. In each of these sections not only are the results described, but also the instruments for categorizing and analyzing the data. It was assumed that treating these matters together in the same section was more convenient than treating them in separate sections.

In Chapter 8, which is devoted to discussion, the main results of this study are briefly evaluated and the implications and limitations of this investigation are reviewed.

2. EDUCATIONAL THEORY IN TEACHER EDUCATION

In this chapter some aspects that are relevant with respect to the function of educational theory in teacher education are treated. This concerns the professional character of teaching as an activity based on a 'body of knowledge' (section 2.1), the relationship between the perceived role of educational theory and one's conception of teacher education (section 2.2.), the delineating of our position in relation to some approaches that have the practical, instead of the theoretical, aspects of teaching as their focus of attention (section 2.3.), the question whether there is, apart from the teachers' readiness to use it, a body of knowledge available that could improve the quality of their functioning (section 2.4.) and the dilemma between using educational theory for prescribing teacher behavior versus enhancing teachers' interpretative abilities, and its consequences for teacher education (section 2.5). In section 2.6 some choices (insufficiently covered in the previous sections) made in the present study are discussed.

2.1. Educational theory and the teaching profession

This study is about the content and function of educational theory in the training of teachers as professionals. The professional character of teaching is a recurrent theme in the literature on teaching and teacher education (Knoers, 1987; Kennedy, 1987; ARBO, 1988), especially in recent years when the quality of teacher education has been heavily criticized (e.g., Holmes Group, 1986).

In this section no attention will be paid to the professional status of occupations as it is studied by sociologists. For our purpose it is sufficient to state that certain occupations, such as medicine, law, etc., are generally considered 'professions'. Although the lists of characteristics presented by various authors are not identical, there are a number of characteristics that are almost always mentioned as essential for calling an occupation a profession. A profession (1) has agreed-upon performance standards, (2) provides an essential service to society, (3) enjoys a high prestige in society, (4) is organized into professional organizations, responsible for maintaining high (ethical) standards of performance, and (5) possesses a systematic body of knowledge that is based on one or more undergirding disciplines (Howsam et al, 1976; Hoyle, 1980a; Cruickshank, 1985). In this section we will discuss the last mentioned characteristic of professions. The question is to what degree does teaching meet this criterion and to what degree is this reflected in teacher

education. Professional behavior, based on a systematic body of knowledge, is impossible without a systematic introduction to that body of knowledge. Some sociologists even state their criterion of professional knowledge in terms of professional training. Freidson (1970), for example, mentions a collectivity or service orientation and a prolonged specialized training in a body of abstract knowledge as the two most important characteristics of professions.

Educational theory has a well-established place in teacher education programs. In most countries of the western world the teacher education program is subdivided into the components of general education, practice teaching in schools, subject matter knowledge (biology, etc.) and educational theory (Stones, 1987). Sometimes educational theory is further subdivided into 'educational foundations' and 'method courses' (Houston & Newman, 1982). In the USA and England general education has gradually gained importance: the total amount of time spent on general education is even more than the time spent on educational theory (Smith, 1980). However, even in these programs the time devoted to educational theory remains substantial.

Given that educational theory certainly has a place in teacher education, the question at issue is whether the function of this theory conforms to the function of a body of systematic knowledge in professions. There is general agreement that this is not the case. Cruickshank (1985) states that whenever teaching is compared to lists of characteristics of professions it almost always appears that it lags well behind such professions as medicine and law. He continues: "The most serious obstacle preventing teaching from having true professional status is the lack of consensus among educators regarding what constitutes the requisite specialized body of knowledge and skills for effective teaching." As early as 1974 McPeck & Sanders, while discussing "a specialized literature as an intellectual basis for practice" as one of the necessary conditions for an occupation being considered a profession, observed that teacher training institutions fail to make appropriate use of the educational literature and theories that are available, thereby failing to train prospective teachers as bona fide professionals. In their opinion, this is related to the more universal failure of educators to understand the conditions that are necessary for their own professionalization. Referring to the way teacher education programs are designed and validated, Sprinthall & Ties-Sprinthall (1987) call teacher education "a practice without theory". This is related to the fact that teacher education programs generally were developed without regard to the outcomes of research (Smith, 1980). Creemers (1986) remarked that educational innovation, research on teaching and teacher training in The Netherlands developed independently without paying much attention to each other. Howsam et al (1976) contend that the occupation of teaching can be

characterized as a "semi-profession", meaning that only some of the characteristics of a profession apply. In the view of Howsam et al, the most obvious aspect in which teaching falls short of being a profession is the fact that there is no agreement among the people involved about what constitutes the essential body of common theoretical knowledge. Besides, they observe that new findings from research and theory enter teacher education very slowly. In their view, educational theory is necessary to provide "conceptual illumination of the issues, problems and procedures confronting contemporary educators". They observe that there is some opposition against expanding the role of educational theory, but that there is sufficient theoretical knowledge on which to base the profession of teaching.

Several authors doubt whether striving for professional status for teaching is realistic. Many remark that also teachers' craft knowledge should in any case be granted a legitimate place in their professional activity (Hoyle, 1980b) or even that in the professional practice of the teacher systematic knowledge is subordinate to craft knowledge, indicating that only a relatively small part of professional practice can be ruled by systematic knowledge. This point will be further discussed in section 2.3.

It may be concluded that there is agreement about the statement that up to now only a small part of the teacher's activity has actually been based on a body of theoretical knowledge (cf. Gage, 1978). However, while some conclude that we should instead concentrate on matters like the teacher's "craft knowledge", others have decided that training has been inadequate and that in the occupation of teaching the a-theoretical culture should be replaced by a more professional culture. Anticipating the contents of sections 2.5 and 2.6, it can be stated that, in our view, the descriptions of professional knowledge are unnecessarily restricted, assigning only prescriptive meaning to educational theories. Our own notion of professional knowledge is related to Doyle's. Doyle (1985) distinguished two general conceptions of professionalism, (a) one which emphasizes the technical and moral attributes of members of an occupational group, and (b) one which stresses the social power and occupational status. The first one in particular has to do with the role of educational theory. A profession is supposed to have at its disposal a core of specialized technical knowledge. Doyle criticizes the fact that when we think of 'theory' in the context of teaching, we tend to think of explanatory systems. He makes a plea for developing teachers' professionality with the help of theories that elucidate the commonplaces of daily events in classroom environments and not defining teachers' professionality in terms of 'applying' recipes that are based on research outcomes.

That teachers attach little importance to educational theory for their

daily classroom work is reflected by (prospective) teachers' skeptical attitude towards educational theory in general. Sanders & McPeck (1976) observed that student-teachers use the terms 'theory' and 'practice' as opposing ones, adding a pejorative meaning to the first term. For student-teachers these terms describe the discrepancy between idealistic prescriptions of teaching that are prevalent in teacher education and the realities of everyday classroom life. It has long been known that in this respect teachers make an exception for those elements of educational theory that have a direct relationship to their work in the classroom (Clinefelder 1979; Isakson & Ellsworth 1979; Van Note Chism, 1985). This might tempt the teacher educator to concentrate exclusively on those matters that can immediately be applied in the classroom. In the worst case this could lead to restricting oneself to a number of 'how to do' rules, without fostering any deeper understanding of the teaching-learning process. Many authors (McPhie, 1978; Stones, 1983) warn against providing prospective teachers with 'tips' that might work in some conditions but, without knowledge of the more fundamental principles and basic theoretical concepts, would be senseless or even harmful in other situations. In any case it reduces the teacher to a thoughtless user of 'rules of thumb', quite the opposite to being a professional in the sense just discussed. The teacher educator's position is further complicated by the fact that, on the part of student-teachers, a certain degree of readiness is necessary before it makes sense to confront them with more abstract educational theory (cf. Elbaz, 1981). Unless the student-teachers have made a 'shift to pedagogical thinking' (Feiman-Nemser & Buchmann, 1986), it may be premature to confront them with this theory.

One possibility to solve the theory-practice problem in the education of teachers as professionals is to concentrate on practice, thereby giving up the idea of teaching being a profession in the traditional sense (cf. section 2.3). In this study the opinion is held that educational theory should have an important place in teacher education. Given the fact that abstract theoretical knowledge as such is not highly valued by student-teachers (although there is some evidence that they do value teaching models as frames of reference for teaching; cf. Bjørndal, 1987), theory and practice will have to be presented in a unity that makes sense to the student-teachers.

In many of the existing teacher education programs educational theory is presented as either extremely theoretical, with little reference to practical applications (e.g., 'psychopedagogy', taught in some European countries), or almost exclusively practical, like 'didactics', which mostly considers approaches to teaching without drawing on any general body of theoretical principles (Stones, 1987).

The present study can be seen as an attempt to link theory to practice without spoiling the essence of educational theory.

2.2 Educational theory and the conception of teacher education

In the previous section it was stated that the availability of a body of theoretical knowledge should be considered an essential quality of teaching as a profession; the great differences in opinion that exist concerning the role of educational theory were ignored. For that reason, we will in this section briefly discuss the various conceptions of teacher education and the role educational theory can play within these different orientations.
It is clear that the function one assigns to educational theory in teacher education is not independent of one's perception of teaching in general. We cannot pursue these types of philosophies here. They are concisely summarized in characterizations of teaching as "art or science" (Dunkin, 1987) or "teaching as technology, teaching as an art or teaching as a craft" (Harris, 1982). Concentrating on the conceptions of teacher education, the distinction that is historically the most pervasive is the one between 'competency based' teacher education, concentrating on behaviorally defined skills (which will be more extensively treated in section 2.5.1.) and 'humanistic' teacher education. Proponents of the latter concentrated on the development of teachers' personalities; according to Combs et al (1978), the most prominent advocates of humanistic teacher education, "a good teacher is primarily a unique personality". Humanistic teacher education is related to the cognitive orientation that will be discussed in section 2.5.2. insofar as it dismisses as too limited the training of teachers in behaviors that have proven to be effective. There are, however, also a number of differences. In the seventies humanistic teacher education came under heavy criticism, mainly because it ignored methodological rigor (Osborne & Beeken, 1976).

Several reviews of ideological orientations in teacher education are available that are more detailed than the dichotomy just mentioned. Joyce (1975), for example, distinguished between the traditional apprentice-novice view of teacher education, in which the prospective teacher just tries to imitate the master, and four more recent orientations in teacher education: the progressive movement that aimed at social change, the academic orientation which asked the teacher to think like a scholar and to 'practice the discipline' with the children, the personalistic orientation that stressed the uniqueness of the individual development and the competence orientation. For our discussion of the role of educational theory within the various ideological orientations, we will use Zeichner's survey

of alternative paradigms in teacher education (Zeichner, 1983). Zeichner distinguishes between behavioristic, personalistic, traditional-craft and inquiry-oriented teacher education. Behavioristic teacher education emphasizes the development of specific and observable skills of teaching which are assumed to be related to pupil learning. It is clear that in this paradigm educational theory mainly concerns the cause-effect relationship between teacher behavior and pupil achievement. If the teachers are supposed to function as 'executors of the laws and principles of effective teaching', they should be familiarized with these laws and principles during their training. All the approaches that belong to the paradigm of personalistic teacher education try to foster psychological maturity in prospective teachers. They are largely based upon self-perceived needs and concerns of prospective teachers. Here all theoretical notions that may be helpful for the student-teacher to determine the substance and direction of his or her own professional education are seen as appropriate. Within the traditional-craft paradigm the prospective teacher is seen as an apprentice who gets his or her information from the master teacher, mostly in the form of tacit, barely explicated 'cultural transmission'. The basic source of theory is the professional wisdom of the expert teacher. It is assumed that this wisdom is more or less accumulated in the minds of the practitioners. The last approach, the inquiry-oriented paradigm, tries to foster not only the development of technical skills, but also the skill to analyze one's own behavior in terms of effects upon children, schools and society. The teacher is seen as an active agent, who is able to control and change his or her own situation. Relevant theory is related to the development of technical skills or to insights that may promote 'reflective action' in the teacher.

The behavioristic movement, and especially the ways it differs from our own approach, is discussed in section 2.5.1, so no additional attention needs to be paid to it here. Those aspects of the personalistic and the traditional-craft approach that are relevant to our study are treated in section 2.3.1. With respect to the personalistic approach, this pertains to the emphasis on student-teachers' concerns as the starting point for the teacher education program, while the traditional-craft approach is visible in the procedures for probationary school teaching that are described in that section. As to the inquiry approach, which is more frequently labeled 'reflective teaching' (Cruickshank, 1980; Zeichner, 1982; Zeichner, 1987; Krogh, 1987), it can be remarked that in the strategies that have been used to promote reflectiveness in prospective teachers (cf Zeichner, 1987), the role of educational theory was generally a very limited one.

2.3 The primacy of practice

2.3.1 Student teaching

In the present study a procedure is described for familiarizing the student-teacher with educational theory at the teacher training institution. In the part of the procedure that is covered in this study there is no role for the collaborating school. Besides, the starting point lies in the relevance of educational theory for prospective teachers and not, for example, in the 'concerns' the student-teachers develop on the basis of their practice teaching.
Both matters imply a choice that can be brought up for discussion. In the present section these choices are justified; critical comments are made about student teaching as it is practiced nowadays and about considering student-teachers' concerns as the basis for developing a teacher education program. In other words, the 'primacy of practice' is challenged as far as it concerns the experiences student-teachers are required to have.

One of the most striking characteristics of probationary school teaching is the fact that the theoretical perspective is virtually absent in the guidance given by the collaborating teachers. Supervision by teacher educators usually occurs very seldom and the practical advice given by the collaborating teachers is based entirely on craft knowledge. A number of authors even see the great amount of time spent on practice teaching, and the predominantly imitative behavior of the student-teacher during that period, as one of the most important impediments to acquiring a deeper theory-based understanding of the teaching process. The danger that premature placements of teaching candidates in classrooms would lead to thoughtless imitation of the cooperating teacher's practices was already observed by Dewey (cf. Denton, 1983). According to Denton, student-teachers should be introduced to learning and development concepts prior to their initial field experiences. Lasley (1980) also warns against the tendency to increase time spent in probationary school without providing the prospective teachers with the theoretical principles for interpreting what they are observing there. From attempts to bridge the gap between theory and practice by intensifying the contacts between the teachers' college and the probationary school (e.g., Cohn, 1981a; Cohn, 1981b), it is clear that this will in any case require much time and effort from the part of the teacher educator, in order to participate more in practice teaching situations of the student-teacher; in fact, it requires a redefinition of the role of the participants (Cohn & Gellman, 1985). In our view, a great value of such an approach would be that it might urge the teacher educator to explicate the possible function of educational theory for classroom teaching.

Apart from the neglect of educational theory, the main critique on student teaching is that it forces the prospective teacher to adapt to existing practices without getting the opportunity to test or challenge them. As remarked by Joyce (1975), apprenticing the novice to the elder is a very effective method for preventing change in every social institution. The infrequent visits of the teacher educator are hardly a compensation for this mechanism: from a number of investigations (recently Calderhead, 1987) it appears that during practice teaching the student-teachers have the supervising teacher as their frame of reference and disregard the teacher educator's comments if they do not fit into the supervising teacher's practices.

Although it is well-known that student-teachers generally insist on increasing the time spent in probationary school, there is no research-based evidence on the basis of which this should be advocated. Cruickshank (1980) points to the fact that there is no evidence of a consistent relationship between the number of hours spent in practice teaching and teacher effectiveness, no matter how this effectiveness is measured. Applegate (1987) concludes that at this moment little is known about the actual contribution of practice teaching to a teacher's education. An even more negative conclusion is drawn by Watts (1987), who, on the basis of the research available at this moment, concludes that the present student teaching programs must be characterized as generally unsatisfactory and regressive to the professional development of student-teachers. For a summary of the critique on the current practice of student teaching, especially as far as it promotes passive adaptation to existing habits, see Zeichner (1982).

On the basis of the critiques just discussed, it might be prudent to diminish the importance attached to practice teaching. In 1972 Kieviet stated that in teacher education relatively greater emphasis should be placed on training at the teachers' college, compared to teaching practice in the collaborating school. We are of the opinion that this still makes sense.

The same line of reasoning that leads to emphasizing practice teaching also generates a tendency to take teachers' concerns as the starting point for the teacher education program and attuning the contents of the teacher education program to the 'survival needs' of the student-teachers during their practice teaching or to the needs that arise from their stage of personal development. Some (Kleine & Smith, 1987), in their plea for taking into account the personal knowledge and individual experiences of the student-teacher in the teacher education program, even go so far as to advocate involving the individual life histories of prospective teachers.

The question is whether ultimately the concerns-based approach serves the

student-teachers well. There is a real danger that the student-teachers gain an improper notion of the character of professional activity. After all, it is not the individual professional's concerns, but the goal of the professional activity which should be the center of attention. The approach in teacher education that starts from student-teachers' concerns was also criticized by Buchmann (1985). In her opinion, this approach runs the risk of stimulating the student-teachers to attach too much value to personal and idiosyncratic preferences. Important curricular decisions should not be based on the personal preferences of teachers.
Although student-teachers may feel comfortable if their concerns are the main focus of interest during their training, this certainly does not imply that the content of that training is relevant for their professional work (cf. Zeichner & Teitelbaum, 1982).

2.3.2 Craft knowledge

Taking practice as the starting point can, apart from the matters discussed in the previous section, also pertain to attaching high value to the craft knowledge of expert teachers. Recently there has been a growing interest in teachers' craft knowledge. The focus of attention is not so much on the average teacher's craft knowledge (cf. Schlee, 1980), but on the craft knowledge of the expert or effective teacher. The related investigations aim at depicting the essential and valuable elements of this craft knowledge, after which these data might be used in the teacher education program. Although in the present study we concentrate on another 'source' of information for developing a teacher education program (i.e., existing educational theories), we consider depicting teachers' craft knowledge a valuable and meaningful endeavour. In this section we will indicate the relationship between this kind of endeavour and our own investigation.

The current interest in research on teachers' craft knowledge is probably related to a growing awareness that process-product research is incapable of providing complete and sufficient prescriptions for the teacher's daily behavior. In her article 'The use of research knowledge in teacher education and teaching' Buchmann (1984) discusses the concept of knowledge utilization and warns against an overreliance on research knowledge. She argues that striving for practical wisdom is the main goal and that common sense and normative requirements can be valid bases for action. Stressing utilization of knowledge too much ignores the fact that problems in the practicing professions do not primarily derive from deficiencies in knowledge.

In the present study we also start from the premise of improving the teacher's functioning. It is assumed that cause-effect relationships can be found for only a limited part of the total teaching behavior. The most important function of information from theory and research is seen as enhancing the 'practical wisdom' of the teachers by providing concepts and categories for observing and interpreting the classroom reality in a more systematic and detailed way. But also here it is clear that many aspects of that classroom reality will not be covered and be left to the teacher's 'common sense' and 'craft knowledge'. This insufficiency of theory and research is partly attributable to the fact that theorist and practitioner 'live in different worlds'. The theorist, by definition, operates in a restricted model of reality, in which some variables that are extremely important to the practitioner are not incorporated (cf. Munby 1982; Beck, 1983; Kieviet, 1985). A discussion of research into teachers' belief systems in the more general sense will be given in section 3.2.2.

The problematic relationship that exists between theoretical knowledge and the daily work of the professional was plainly articulated by Schön (1983). He observed that in the dominant model of technical rationality the work of the professional is seen as "instrumental problem solving, made rigorous by the application of scientific theory and techniques". At the same time it becomes more and more clear that this concept of application does not account for what professionals really do, coping with situations that are complex, uncertain, unstable, unique and often full of value conflicts. Schön makes a plea for investigating the type of tacit knowledge that is present in the actions of the practitioners ("knowing-in-action") and he offers a number of case studies, illustrating this kind of knowledge. A crucial element is his concept 'reflection-in-action', referring to the fact that professionals think about what they are doing, think "on their feet", especially when intuitive performance leads to surprises, both wanted and unwanted. He criticizes that fact that this type of reflection-in-action is not generally accepted as a legitimate form of professional knowledge. In his view, professionals who engage in reflection-in-action are researchers in the practical context.

The main virtue of Schön's statement is that it calls attention to the fact that an important part of professional activity consists of 'conversation with the situation', instead of the application of technical knowledge, and that it would make sense to find out how 'reflection-in-action' may be rigorous in its own right. These ideas are akin to our own in the sense that also in the present study the prescriptive value of educational theory is seen as limited, while the professionals' own views and interpretations are seen as very important. However, while Schön fully associates scientific knowledge with the declined 'technical rationality' and seems to expect any good from reflection-in-action by the teacher, in the present

study there is an important role for educational theory for illuminating the teachers's practical situation. In our view, having a repertory of concepts and categories at one's disposal is indispensable for starting a "reflective conversation with the situation". Schön does not indicate how the professional will acquire these concepts. The assumption seems to be that this will be automatically acquired during professional practice. Apart from a brief mention of "overarching theories" (p. 273) that supply "language from which to construct particular descriptions and themes from which to develop particular interpretations", theory is remarkably absent in Schön's conception of the work of the professional. Especially with regard to the training of these reflective practitioners, the question arises whether it would not be advisable to derive the instruments for reflection, at least in part, from existing theories, instead of expecting everything from coaching by 'masters' (Schön, 1987; cf. also Stolurow, 1965). Moreover, for the teaching profession to implement a 'master' system in Schön's sense would require a complete redefinition of the roles of the participants, which would be unrealistic for financial reasons. (For a discussion on the application of Schön's ideas to the teaching profession, see Jordell, 1987). A case study describing the practical knowledge of teachers in a way that is, in our view, consistent with Schön's ideas can be found in the work of Elbaz (1983), which is based on a series of retrospective interviews with a high school teacher.

Most investigators of expert teachers' craft knowledge agree that this information can be made useful for teacher education. Few of them will go as far as Collins & Stevens (1982) who, after describing expert teachers' use of the inquiry method, subsequently ascribe prescriptive value to the procedure that was followed by these expert teachers. Most researchers feel that instead of assigning prescriptive value to these findings, they should serve to give student-teachers a better understanding of the essence of the teaching process. Calderhead (1983) states that teacher training should provide the prospective teacher with knowledge about the way experienced teachers think about their pupils, because especially at this point there appears to be a clear difference between expert and novice teachers. A specific proposal for confronting prospective teachers with the craft knowledge of experts was made by Leinhardt et al (1984). She investigated the role routines, defined as "small cooperative scripts of behavior, used to support several activity structures, e.g., choral response, paper passing out", play in the teaching behavior of expert teachers. These routines appear to be very important for speeding up and smoothing the teaching-learning process and for reducing cognitive processing space for both teachers and students while they are striving to accomplish their goals. Because it is extremely important that the prospective teacher also

acquires that kind of routine, Leinhardt et al recommend confronting the novice teachers with several models of expert teachers introducing and using routines. Morine-Dershimer (1986) also sees the establishment of routines as an important task for teacher education.

2.4 The availability of a body of knowledge

In section 2.1 it was stated that working on the basis of a body of systematic knowledge is generally seen as a characteristic of professional activity. It was also observed that the occupation of teaching only partially fulfills this requirement, which, in the eyes of many writers, leads to skepticism about the professional status of teaching. In the present section existing ideas about the availability of such a body of knowledge will be discussed. To what degree is there information from research and theory available that could, apart from the teachers' readiness to use it, improve the quality of the teachers' functioning? Of course the kind of information that can be transmitted during teacher education will be of special interest here.

There have long been opposing views concerning the value of educational theory for teaching and teacher education. An historical account of the debates in educational psychology is given by Conners (1978a). In the seventies, especially in the United Kingdom, profound differences in opinion about the usefulness of educational theory for teaching surfaced. In his publication about the role of educational psychology Stones (1972; also cf. Stones, 1981; De Corte, 1980) made a plea for presenting educational psychology in such a way that its function for everyday classroom behavior becomes apparent to the student-teachers. Among the critics of the role of educational theory in teacher education were Phillips (1976), McNamara and Desforges (Desforges & McNamara, 1977; McNamara & Desforges, 1978). They contended that educational theory has little to offer to the teacher. Theorists fail to take into account the constraints and complexities of the classroom. In the worst case, theory is devoted to isolated and relatively unimportant aspects of teaching and learning. In the best case, it describes in scientific terminology matters that are already well-known to teachers on the basis of their experience and common sense. In the latter case the information is of no practical help to them, because no new information is added; instead it irritates teachers because of its banality. Mostly these authors advise concentrating on the craft knowledge of experienced teachers. This can, in their opinion, be the basis of building a new systematic body of instructional knowledge. They view the

teaching of this craft knowledge of successful and experienced teachers as the primary goal of teacher education.

The most convinced proponents of straightforward application of the findings of research and theory in teaching and teacher education can be found among those working in the 'process-product' or 'teacher effectiveness' tradition. Here the focus of attention is on those teacher behavior variables that are related to high pupil achievement, while, subsequently, these variables can be incorporated in the teacher education program. (In the next section the consequences for the teacher education program will be discussed in detail). In the present study we will not discuss the content of the findings of process-product research. A number of surveys are available, see Rosenshine (1971), Dunkin & Biddle (1974), Borich (1979). More recent surveys were presented by Rosenshine (1983), Brophy & Good (1986) and Rosenshine & Stevens (1986). A summary of process-product results that can be used in teacher education programs is given by Good (1983) and Stallings (1987).
The main critique against the traditional process-product approach concerns the strict confinement to behavioral aspects of the teacher's functioning and also the suggestion that in the end an encompassing theory could be formulated from which prescriptions for teacher behavior could be derived (Lowyck, 1980; Feiman-Nemser & Ball, 1984; Winne, 1984). Feiman-Nemser & Ball criticize the 'applications view' of knowledge in teacher education. According to this view, the role of the teacher is to apply previously acquired knowledge in the classroom situation. This view suggests that the educational theory that is currently available contains sufficient information for prescribing what should do the teacher. According to Feiman-Nemser & Ball, with whom we strongly agree, this orientation in teacher education leads to several types of undesirable consequences. In the first place, because it suggests that application of formal knowledge is straightforward and unproblematic, it will inevitably lead to disappointment on the part of the student-teacher. The student-teacher soon discovers that the theory has no answer to all kinds of practical and urgent questions and that in practical situations all kinds of other matters, like assumptions, practical constraints, etc., play a role (cf. ection 2.3.2.). As a result the student-teachers may, because of these unfulfilled expectations, reject educational theory as a valid source of knowledge. In the second place, this orientation is strictly utilitarian: only the kind of knowledge that can directly be used in behavioral classroom application is considered valuable. This fails to recognize that knowledge can be helpful in interpreting classroom phenomena, for enlightenment and inspiration, apart from whether or not it leads to behavioral prescriptions (cf. section 2.5.2.).

In our opinion, there is a legitimate place for process-product research as a source of information for teacher education, but one should be fully aware of the limitations of this paradigm. Not only are there, apart from information from research, several alternative valid grounds for the teacher's activity, but history shows that all kinds of relationships that were found between teacher behavior and student achievement appeared to be inconsistent in later research. Although operating with reticence is necessary in this field, this kind of research can certainly be useful. Substantial progress has been made in recent years, mainly because of the fact that the effectiveness of large patterns of variables, instead of the effectivess of isolated variables, has been investigated. The most prominent example of this approach is the research on 'direct teaching' (cf. Rosenshine & Stevens, 1986).

Taking for granted that findings from educational theory and research can basically be useful for teaching and teacher education, it is evident that there is no 'grand theory' and that the teacher educators have a variety of divergent theories at their disposal. The question is whether student-teachers should be confronted with a variety of theories and insights or should one, in an eclectic way, provide them with one set of rules that is useful in as many teaching-learning situations as possible. Decisive for one's choice as a teacher educator will be whether or not one feels that the teaching-learning situations the student-teacher will encounter will be fundamentally different from each other or not. Smith (1980) seems to be of the opinion that all teaching can be reduced to a basic pattern in which the elements (apart from the difference between 'didactics' and 'heuristics') are the same. In his view, all knowledge about this pattern can be subsumed under six categories, viz., observation, diagnosis, planning, management, communication and evaluation. In his opinion, the research data (and the 'professional wisdom') should be assembled and the 'principles of effective teaching' for every domain should be classified. What results is a basis for a program for professional training. He criticizes those who contend that there are a number of fundamentally different approaches and who translate these approaches into a number of separate 'models of teaching'. In the present study we start from the assumption that there are a number of approaches to teaching that are fundamentally different and that the types of goals that should be strived for can differ so widely that fundamentally different approaches (and learning processes) are required. Apart from some very elementary matters, the views on the most desirable teaching-learning process, the focus on several types of learning outcomes, etc., can differ so tremendously that one may speak of various 'models of teaching'. Contrary to Smith, we consider the classification of these approaches into 'models of teaching' (as presented by, e.g., Joyce &

Weil, 1980) as a successful attempt to translate the various theoretical approaches for student-teachers. For a related critique of Smith's views at the philosophical level, see Eisele (1982).

The 'models of teaching' movement just mentioned started from the idea that there are a number of defendable theories about how people learn and develop, which are relevant to teachers (cf. Gower et al, 1981), and that these theories should be made operational for teachers. The teacher educator should describe or demonstrate what teachers actually do when they are teaching in accordance with a particular theory. In Chapter 6 it is indicated how this notion has been decisive for the development of our treatment materials. In the early publications of the 'models of teaching' research group are accounts of the basic ideas (Joyce, Soltis & Weil, 1974), the teacher education program at Columbia University Teachers' College (Joyce, Weil & Wald, 1973) and the problems with the operationalisation of educational theories (Weil, 1974). Concerning the latter problem, as can be expected it appeared that the educational theories differed substantially as to their translatability into teaching models. Some educational theories could be extrapolated into a teaching model in a rather straightforward way, while others required substantial inferential leaps.

One more aspect on which our study is cognate to the 'models of teaching' approach concerns the following. Although originally the 'models of teaching' approach should be placed within the 'technical' or 'competency' paradigm (Feiman, 1979; Joyce, 1975), it differs from this paradigm, in which most attention was directed at separate behavioral variables, in an important way. Joyce indicates that in the 'models of teaching' approach not only were specific behaviors trained, but these behaviors were grouped and ordered into larger units or patterns of behavior, becoming an element of the teacher's repertoire. Winne & Marx (1977), while criticizing the competency movement for providing the teachers with too many isolated teaching skills without an organizing framework, also mention Joyce & Weil's 'models of teaching' approach as an exception to this rule.

As will be explained in the next two sections, the present investigation is in the cognitive paradigm (cf. Shulman, 1986), in the sense that attention is focused on improving the teachers' interpretative abilities, rather than on trying to alter the teachers' behaviors in a particular direction. It is remarkable that recently the question whether information about teacher cognitions can itself be useful for teacher education has become prevalent. Adherents of the process-product paradigm translate this into the question whether 'effective' cognitions can be determined, i.e., cognitions of the teacher that are related to particular student achievement. Gage & Needels (1987), while defending the process-product approach against the criticism

of neglecting the cognitive aspects, make a plea for including cognitive variables in process-product research. Peterson (1988) in this context speaks about including teachers' (and students', cf. Winne, 1987) cognitional knowledge as "mediating variables in effective teaching". Incorporating teachers' cognitive processes in the process-product paradigm was also advocated by Berliner (1986).

Meanwhile, little empirical research in this area is available. For example, Clark & Peterson (1986) report that in the field of teacher decision making they could find only three studies on the relationship between teachers' interactive decision making and student achievement.

The next step in this line of reasoning is of course employing this kind of information in teacher education. As early as 1973 authors on teacher decision making like Shavelson (1973) and Bowles (1973) recommended making decision making a component in the teacher education program. At the moment the discussion centers on the question of how this information should be brought to the student-teacher's attention. While the adherents of the process-product paradigm advocate training in cognitions that have proven to be effective, the adherents of the cognitive orientation have less unequivocal ideas about this. In Clark's (1988) opinion, researchers on teachers' cognitions should provide information that can illuminate the teacher educator's thinking about the teaching process. Instead of providing well-defined prescriptions about how (prospective) teachers 'ought to think' to be effective, they should provide illuminative concepts and methods. Floden & Feiman (1980) also warn against attaching prescriptive meaning to findings from teacher thinking research. Rather than seeing the data from teacher thinking research as normative for preservice and inservice teachers, they consider them to be a source of inspiration for these practitioners. Learning about the thought processes of other teachers can stimulate your own reflections and open up new perspectives.

Our own opinion is that as far as prescriptions for preservice and inservice teachers are concerned, the reticence that is recommendable with process-product research results is also at issue with the research on teacher cognitions. The main function of theoretical insights gained from research on teacher cognitions is analogous to the main function of educational theory in general as it is conceived in the present study: as a means of enhancing teachers' interpretative abilities, and as a means of gaining a better understanding of the complexities of classroom life. We fully agree with Clark & Lampert (1985), who see an important use of research on teacher cognitions as providing prospective teachers "with a realistically complex picture of the cognitive aspects of teaching".

2.5 Theory for prescription or for understanding: consequences for teacher education

This section is, obviously, not about the character of theory in general (which principally devises models for depicting reality, and cannot have any prescriptive value, cf. Beck, 1983), but about the use that is made of theory in teacher education.

The prescriptive value of educational theory has, evidently and understandably, been very strongly advocated within the process-product tradition. The clearest and most elaborated expression of this concerns the training of prospective teachers in precisely defined behaviors, with the aim of attaining precisely defined goals. In this respect the microteaching approach has attracted particular attention. In the next section this will be discussed in more detail.

Some authors suggest that it were mainly the users of process-product results, rather than the researchers themselves, who stressed the prescriptive meaning of the research data. According to Shulman (1986), the researchers within the process-product paradigm, in their search for lawful relationships between teaching and learning, never intended to reduce the teacher to just an implementor of their findings. Citing Gage (1978), he stresses that the goal was "the artful practice of teaching to be grounded in scientific propositions as much as possible" and surely not the formulation of technical maxims that should be substituted for pedagogical judgment. Although he may be right that designers of some teacher evaluation and staff development programs have exaggerated the implications of process-product results and translated them into rather inflexible evaluative standards, it seems incorrect to blame only the users of the research data for this. Prescribing effective teaching behavior has been central to all process-product research, and referring to matters like 'pedagogical judgment' is the exception rather than the rule in teacher effectiveness literature.

It is true that in recent years the prescriptive stance of process-product research has mitigated. Brophy & Good (1986), for instance, admit in their review of results of process-product research that in the past educational change was based on simple theoretical models and that the 'solutions' following from the research were often simplified and rigid. Talking about the role findings from research should play, they dissociate themselves from "trying to translate these into overly rigid and generalized prescriptions", but instead recommend that "teacher educators should present this information to teachers within a decision-making format that enables them to examine concepts critically and adapt them to the particular contexts in which they teach." It might be expected that in the near future the development will continue in this direction. Shavelson (1985), talking

about the important payoffs for teaching practice which he expects from future research on teaching that is inspired by cognitive psychology, expresses the expectation that these data will "not prescribe what teachers should do", but provide a framework, enabling the teachers to accommodate it to their particular needs (concerning their own strengths, the needs of their students and the teaching context).

The approach that is an alternative to prescribing teachers' behavior on the basis of research results stresses the importance of information from research and theory for enhancing teachers' interpretative abilities and for sensitizing teachers' perceptions (Akinpulu, 1975). The focus of attention is not on changing behavior, but on changing cognitions. A well-known illustration of this approach from the past, to which our study is strongly related, is the protocol materials movement. Because this conception of the function of educational theory is akin to the one underlying the present investigation, it will be rather extensively discussed (section 2.5.2.).

The two possible functions of educational theory lead to quite different procedures at the teachers' college. The two functions of educational theory that we discerned closely parallel the two types of skills that, according to Orlosky (1980), have to be mastered during teacher education. Orlosky distinguishes three components of the teacher education program, viz., (1) general knowledge as provided in liberal arts studies, (2) specific subject matter knowledge, and (3) pedagogical knowledge. Within this pedagogical domain, teachers should obtain 'interpretative skills' and 'performance skills'. While the latter is fostered by practice teaching, the former is fostered through the acquisition and use of concepts from educational theory. He warns against teaching those conceptual skills in purely theoretical courses, because in that case the learning context (classrooms) is very different and there is no certainty that student-teachers will be able to recognize the pertinent concepts in real classroom behavior.
In many outlines of teacher education programs, the two possible functions of educational theory that we mentioned can be discerned. Clark & Yinger (1980), for example, distinguish four professional tools teacher education has to provide: (1) technical skills and strategies for instruction and management, (2) subject matter knowledge, (3) concepts and categories for seeing, understanding and thinking about teaching and learning, and (4) a view or preview of what the profession is or could be for the teacher. It is not too difficult to locate the behavioral-prescriptive function of educational theory under the first heading and the cognitive-interpretative function under the third one.

A much cited enumeration of the components of a high quality teacher education program for the training of teaching skills was given by Joyce & Showers (1980). They distinguish theory, demonstration, practice, feedback and coaching for classroom application. On the basis of research results of a great number of studies they conclude that the most effective training activities will be those that combine the five components.
In our study we confine ourselves to the question what results can be attained with the first two components and focus on the teachers' cognitions. This does not imply an underrating of the importance of the other components. The choice was based on a number of theoretical considerations (cf. sections 2.5.2 and 2.6). There are reasons to suppose that the importance of the first two components has been heavily underestimated.

2.5.1 Changing teachers' behaviors

The most important movement in the field of teacher education that aimed at changing teacher's classroom behavior is the movement that in the USA was called Competency Based Teacher Education (CBTE). Its main characteristic is that the teacher training program (and assessment) is based on a carefully designed list of competencies that are supposed to contribute to effective teaching behavior. The student-teachers are required to meet the minimum standards for each of these competencies. The student-teachers know the specific requirements beforehand and are assessed mainly on their performances (instead of on their knowledge). All program elements that do not directly bear on attainment of the competencies are eliminated. Most CBTE programs have been highly individualized and modularized (Elam, 1972). The CBTE movement, which was the most prominent approach to teacher education in the seventies, can be seen as an element of a general development in education that stressed measuring learning outcomes in behavioral terms. The concept was particularly employed in all kinds of vocational (mainly industrial and military) training. In teacher training, the exact determination of the required competencies has been a pervasive problem for those developing CBTE programs. In the absence of sufficient process-product research outcomes one had to resort to such sources as the common sense of teachers and administrators about valuable teacher behaviors, task analysis or needs assessment, to produce the extensive lists of required performances (e.g., Turner, 1973; Joyce, Soltis & Weil, 1974; Dick, Watson & Kaufman, 1981). In fact, the models of teaching specified by Joyce & Weil, which were the basis of the treatment materials in our present study, grew out of the felt need for coherent theories for deriving valuable behaviors.

In his retrospective overview of the CBTE movement, Houston (1987) concludes that although in comparative studies within colleges CBTE-trained teachers usually outperformed traditionally trained ones, for CBTE in general it holds that "almost no basic definitive research was conducted to prove or disapprove its effectiveness". The criticism of CBTE mainly focused on the fact that all learning in CBTE was predetermined, externally controlled and lacking attention for the student-teacher as a person. Relevant for our present study is the criticism of 'anti-intellectualism', meaning that CBTE in fact detached teacher behavior from its knowledge base: an actor imitating the required teaching performances would, without any knowledge of the underlying meanings, be able to fulfill the requirements. One could interpret those criticisms as the first sign of attention to teachers' cognitions that would become so important in later studies.

The most important training method that was akin to the competence-based approach to teacher education and centered on direct change of teacher behavior was microteaching. The essence of microteaching pertains to the simplifying of the complexities of the teaching-learning situation (Perlberg, 1987). After viewing a model teacher practicing a particular skill, the student-teacher, focusing on that particular skill, teaches a short lesson to a small group of pupils. The lesson is recorded, the student-teacher receives feedback and teaches the lesson again, until an acceptable level of mastery of the particular teaching skill is achieved.

There has been a great number of investigations regarding the importance of the various components of microteaching, (Fuller & Manning, 1973; Finlayson, 1975). In one of the earliest investigations into the effects of these components, Borg et al (1969) found that the components 'videotape feedback' and 'practice' were not essential for gaining higher posttest scores. This might be interpreted as indicative of the importance of the other components.

There has been a host of studies proving that the practice component was not essential for microteaching to produce gains in teaching skills. In particular, comparisons were made between groups that got practice and groups that got discrimination training in the relevant concepts (and all kinds of variants on this design). Hargie & Maidment (1978), after reviewing a large number of studies on microteaching, concluded that discrimination training is a critical element for obtaining the effects of microteaching as found in those studies; essential is that the prospective teachers "be taught what exactly is important in classroom practice and be able to identify the critical features involved". An important advantage of obtaining behavioral effects on the basis of discrimination training rather than on the basis of classroom practice concerns the reduction in time the trainee will have to spend on actual classroom teaching.

In a retrospective review, MacLeod (1987), on the basis of discussions of research on microteaching, concludes that the role of practice in the acquisition of skills may be less critical than it has been assumed to be. MacLeod attributes the emphasis on the component of practice during the microteaching movement to the fact that the rise of microteaching paralleled the rise of process-product research on teacher effectiveness, which showed a strong preoccupation with observable teaching behavior.

It is remarkable that those who have traditionally been adherents of microteaching have after some time started to search for cognitively oriented explanations of the effects of microteaching programs. Griffiths (1977), on the basis of the work of, among others, Bierschenk (1974), explicitly drew attention to the cognitive aspects of microteaching. He observed that the feedback component in particular was no longer exclusively seen as a means for shaping behavior, but also as a means for providing the student with information for changing his or her conceptual schemata of teaching.

A principle in microteaching-research that is of some relevance to our study concerns the principle of 'modelling'. Most discussions of this principle contain references to Bandura's (1977) social learning theory. While 'learning by observation' has always been important in teacher education processes (cf. Putnam & Johns, 1987, for a discussion of the functions of 'demonstration teaching' in general), in most microteaching programs confrontation with some model is a fixed component, usually in the form of a videotape of the skill to be practiced. To justify this, developers mostly refer to Bandura's investigations that proved that filmed models can be as effective as live ones. Although in microteaching research all kinds of experiments have been done regarding components of the modelling process, (e.g., comparing the effects of positive and negative models, Koran, Koran & McDonald, 1972), only after some time was an attempt made to interpret the learning process taking place during modelling in microteaching in terms of internal cognitive processes. An important finding in this respect is that the effect of modelling is highest if it is combined with some form of discrimination training, requiring the student-teacher to discern positive and negative instances of a particular skill (MacLeod & McIntyre, 1977b; McIntyre, MacLeod & Griffiths, 1977). This has also drawn attention to the cognitive component of microteaching, or, as MacLeod (1987) stated "inferences from research on microteaching suggested that microteaching should be viewed as a procedure facilitating long term change in student-teachers' thinking about teaching, rather than short term changes in their teaching behavior". So, after some time, the focus of attention seemed to be no longer the teacher's actions, but the cognitions that lay behind them. In the next section this will be discussed in depth.

In MacLeod & McIntyre (1977a) the main goal of microteaching is seen as

changing teachers' cognitive structures (conceptual schemata), providing them with "easily operationalisable constructs" to handle the complex classroom situation. Especially interesting to our present study is their observation that if theory-based concepts were used in this endeavour, this would automatically lead to bridging the gap between theory and practice and, in consequence, would lead to a more satisfactory assessment of the relevance of theory by the participants.

2.5.2 Changing teachers' interactive cognitions

In the present study the treatment materials were developed to affect the cognitions of prospective teachers. For that purpose we used video-recordings of classroom situations in which elements from educational theories could be discerned. Because the student-teachers were requested to interpret the video materials in terms of the pertinent educational theories (see section 6.1), it was expected that the student-teachers would get a meaning from the theory elements that was related to and meaningful for practice. This procedure is akin to the method that was followed by those employing protocol materials, a type of training material that will be discussed shortly. Also within the protocol materials movement filmed classroom events, ('protocols'), were used in an attempt to build a direct relationship between educational theory and classroom practice, thereby affecting student-teachers cognitions. The basic idea behind this approach is that the student-teachers, by virtue of having a repertoire of practice-related concepts at their disposal, would be better able to interpret and to understand what is happening in the classroom. Thus, an enrichment of teacher cognitions is at issue, rather than a change of these cognitions into a particular direction. It was also not the aim to train teachers to make all kinds of classroom decisions as rationally as possible (cf. Floden & Feiman's (1980) skepticism in this respect).

It is essential to notice that also in our study enhancing teachers' interpretative abilities is seen as something worthwhile in its own right. If teachers have at their disposal a richer, practice-oriented repertoire of concepts, an important step towards professionality has been made. The next most obvious step would be employing this in practice, in which the role of the relevant cognitions can be seen as 'mediating' the behavior (Gliessman & Pugh, 1987; Peterson, 1988). As indicated in section 2.5.1, it may even be expected that our type of treatment will influence teaching behavior without practice training having taken place. It is remarkable that also Joyce & Showers (1986), whose 'models of teaching' we used as content of our treatment, state in their paper about teaching skills, that "it appears

to us that the really difficult and interesting skills of the theory-driven models are cognitive, both in the preactive and in the interactive phase".

Because the protocol materials are akin to our treatment materials, some remarks about the protocol materials movement will be made here. Cruickshank (1985) who, after an extensive review of a series of teacher education curricula, calls protocols materials one of the four "promising alternatives" for classroom practice (besides microteaching, simulations and reflective teaching), provides a more comprehensive account of this approach, (also cf. Cruickshank & Haefele, 1987). Protocols materials were mainly developed in the seventies in the USA. They consisted of filmed or videotaped classroom behaviors that exemplified theoretical concepts. They were used in preservice teacher education, mainly to train these student-teachers in interpreting classroom events in the light of educational theories. During the seventies, about 140 packages of materials were produced, field tested and disseminated (Smith, 1980). Primarily because both development and evaluation had to be accomplished in rather short time-spans, the evaluation suffered from several weaknesses. A review of the types and results of evaluations of these materials is given by Verloop & Hendriks (1979).

A very important positive by-product of the protocol materials movement was that it urged the developers to define clearly and unambiguously the educational concepts they used in their materials (cf. Orlosky, 1980). Although, as already specified, protocol materials also proved to affect teacher behavior (cf. Wagner, 1971; Borg & Stone, 1974; Borg, 1975; Borg, 1977), the original orientation and the main focus were no doubt on teacher cognition. Protocol materials were meant to illuminate teaching situations for the teachers by describing and interpreting such situations in terms of educational theories and concepts. The cognitive orientation of the protocol materials movement is unquestioned and is emphasized by all authors in this field (Grant, 1976; Cruickshank & Haefele, 1987).

Initially protocol materials were conceived as original recordings of classroom events; only in the second step was it necessary to discuss which theoretical concepts could be useful for a better understanding and interpretation of these events. Gradually another conception became apparent (e.g., Borg & Stone, 1974) which strived for "illustrating educationally relevant concepts with filmed or videotaped lesson episodes". Cruickshank & Haefele (1987) labelled these two views, the 'orthodox view' versus the 'reformist view'. The second one is adhered to in the present study. We are of the opinion that learning to "analyze new situations against a firm background of relevant theory" (according to Smith's basic publication (1969), the ultimate goal of the protocols approach) is hardly possible when this theory is not presented in a systematic way. In our

view, the 'events first' approach makes training too dependent on the accidental character of the classroom situations that occur and, even more important, may lead to learning theoretical concepts that are detached from their theoretical context.

The approach proposed here aims at better conceptual understanding of classroom phenomena by student-teachers. Particularly in relation to behavioral teaching skills, this conceptual understanding is seen as conditional for a correct and flexible practicing of these skills. The idea is that for every theory-based skill there are a number of concepts that are relevant for understanding the skill and that to master the skill it is essential that the teacher understands the practical meaning of these concepts. The teacher should in any case be able to determine whether a particular behavior is or is not an instantiation of that concept. At issue is grasping the meaning of the theoretical concept which is directly linked to the classroom situation. In this respect Smith (1980) criticizes the fact that pedagogical concepts are typically taught almost exclusively at the verbal level, their meaning for the student-teacher being derived from the context of discourse or from the student-teacher's ordinary experience.

Investigations on this topic suggest that conceptual understanding is not only conditional to acquiring flexible and theory-related teaching skills, but that it may in itself be sufficient for the acquisition of many types of teaching skills. On the basis of the studies of their own research group, together with the evidence from previous investigations, Gliessman & Pugh (1987) conclude that training directed at change in concepts about teaching skills is a highly dependable means to acquire proficiency in the skills themselves. In discussing the implications of these findings, they assert that "concept mastery should be the primary goal of skill training", (also cf. Gliessman & Pugh, 1984). In an extensive meta-analysis of the variables influencing the acquisition of the generic teaching skill 'questioning', Gliessman et al (1988) found that no differences in effects could be discerned between studies in which instruction without practice was the independent variable and studies in which the student-teachers got both instruction and practice. They comment: "This analysis places skill acquisition clearly within the domain of conceptual learning (...). This position suggests that the principal outcome of training, no matter what its form, should be possession by the trainee of clearly delineated concepts by which he or she can monitor his or her use of the referent behaviors or skills." Moreover, they point out that although instruction plus practice did not result in a greater gain in skill compared to instruction alone, it consumed about four times as many hours, leading to questions about the efficiency of this kind of procedure.

Of course, the most obvious justification for emphasizing conceptual understanding is the common sense notion that one is better able to apply something when the details of it are clearly understood. That this is also relevant in relation to the implementation of classroom practices was found by Mohlman, Coladarci & Gage (1982) in their review of the implementation practices in five experiments on teaching effectiveness.

As far as teaching skills are concerned, another consideration, also already raised by Wagner in 1973 (1973a; 1973b), is at issue here. Many teaching behaviors are basically variants on skills of an interactive, verbal-communicative character, which have been practiced extensively in everyday life. What the teacher needs to learn is not so much the execution of the skill itself, but what educationally relevant details and aspects can be distinguished in it and how these relate to existing bodies of theoret cal knowledge. Learning fine discriminations between the various (theory-based) meanings of behavior can lead to the teacher's awareness of all kinds of details of it, which, subsequently, can produce appropriate employment of a teaching skill. The effects of discrimination training found in many studies might be attributed to this. Because the teacher is principally able to execute the behavior, lengthy training like micro-teaching may be unnecessary. However, unless the teachers have seen the behavior 'in operation' and unless they have learned to distinguish the differences and similarities between the related sets of behavior, they do not know what behavior exactly is expected of them. In other words, it is the cognitive aspect, the learning of conceptual differentiations, directly linked to practical illustrations, which enables the teachers to employ the behavior themselves. This might also account for the fact that in a number of investigations into the effects of microteaching, no differences were found between the conditions with or without practice training, provided both conditions contained discrimination-training, (cf. section 2.5.1.).

In relation to this conceptually based training, Gliessman's (1984) distinction between 'instructional' and 'intervention' variables is relevant. 'Intervention variables' are intended to directly modify behavior. The focus of the intervention is the behavior of the teacher; typically the behavior of the teacher is recorded and replayed on videotape. Intervention variables, e.g., feedback, have been studied intensively in the context of microteaching research. More important to the present study are the 'instructional variables'. The immediate objective of using instructional variables is the acquisition of concepts about, and changes in perceptions of, specified teaching behaviors and skills. The basic idea is that a clear conceptual understanding of the behavior one is to exhibit facilitates the use of it. Gliessman observes that because the skills are typically portrayed through filmed or videotaped materials, not only conceptual

variables are at issue, but also observational ones. The same filmed examples that promote conceptual understanding at the same time "may affect performance more directly by providing models of specific teaching skills" (Gliessman, 1984). Thus, in this type of study it is possible to attribute changes in teaching behavior to modelling, especially if the treatment is confined to viewing the videotape (cf. Lange, 1971; Koran, Koran & McDonald, 1972). However, most investigations have focused on the conceptual variables, mainly by giving the teachers tasks like discrimination-training during or directly after viewing the videotape. This also holds for the present study. The video-treatment is intended to help the student-teacher grasp the practical meaning of the theoretical concepts. Investigating the student-teachers' cognitions after this treatment is the focus of this study. In the additional study into the student-teachers' classroom behavior, it is assumed that cognitive changes have been mediational for changes in behavior. Principally it is possible that because the student-teachers observed the videotape, a learning process has also taken place that can be characterized as modelling. However, because the student-teachers gave their lessons about one month after viewing the videotape, one cannot expect this kind of learning process, if present at all, to lead to substantial effects.

In the previous section the importance of discrimination training for affecting teacher behavior was discussed. An early, more general, investigation into the relative importance of discrimination training (defined as "presenting the trainee with relevant behavioral instances and then teaching him to discriminate between them") was done by Wagner (1971, 1973a). She found that in an experimental design with three experimental conditions, viz., discrimination training, microteaching practice and a control group, the discrimination group outperformed the other two groups on the criterion variable. On the basis of a separately done check on the discrimination performances of all subjects, her final conclusion was that "the crucial difference between the microteaching and the discrimination training was the linkage of verbal concepts to actual behavioral instances". In addition, from her analysis of a series of existing modelling studies, she concluded that most of the results of these modelling studies could be explained as a result of the discrimination activity that was incorporated in it.
Calderhead (1981b) also stated that discrimination training and training in cognitive interpretation of teaching might facilitate teachers' analysis and modifying of their own teaching.
Contrary to, for example, Wagner, Thiele (1978) did not find a significant effect of discrimination training. In his study the student-teachers in the microteaching condition outperformed the discrimination training group on

the criterion variables. He himself believes that the fact that the target behavior (group discussion variables) in his study was relatively complex is an important possible explanation for this difference, but one should also take into account that in his study discrimination training took place with written materials of classroom situations.
Kieviet (1971) found that observing model lessons during methods courses produced significant changes in student-teachers' knowledge of the theory concerned, but did not affect their teaching behavior. In his study the student-teachers were, prior to viewing the tape, asked to pay attention to some central elements, but during observation of the tape no overt activity (like discrimination training) was required from them. In a second study (Kieviet, 1972) on the effects of various components of microteaching, one of the four conditions comprised a structured video-demonstration of two teaching methods, the video-demonstration taking place in small parts and attention was focused on the separate elements of the teaching methods. When the overall teaching results of the student-teachers were measured, it appeared that the student-teachers in this condition outperformed two of the three microteaching conditions: only the full microteaching condition appeared to be superior. These studies suggest that focused attention to details of teaching behavior can have considerable effect on subsequent teaching behavior.

2.6 Choices made in the present study

At various points in the previous sections the choices and assumptions that were the basis of the present study were put forward. In this section we will discuss some of these choices more explicitly and in detail, and introduce some new topics.
The most important point that needs further elaboration concerns our own ideas about educational theory in teacher education, regarding both content and function. Our opinion on those matters will to a considerable extent be explicated by relating and, in part, contrasting it to the ideas of some significant authors in this field, mainly Smith (1980) and Fenstermacher (1986).

In his very influential and much discussed work 'A design for a school of pedagogy' (1980), Smith explores the possibilities of genuine professional preparation of teachers founded on a sound knowledge base. He makes a number of recommendations for designing such a professional 'school of pedagogy'. For our study it is important that he, concerning the knowledge base for the behavior of the teacher, distinguishes two types of peda-

gogical knowledge, namely, 'clinical' and 'academic'. Clinical knowledge is "that which teachers use as they help students, either individually or in groups". This type of knowledge is the verbal counterpart of pedagogical behavior and stems from both research studies and professional wisdom. The other type of knowledge is termed 'academic pedagogical knowledge', consisting of definitions, principles, facts and values that comprise the content of educational history, philosophy, sociology, psychology, etc. In Smith's view, the significance of academic pedagogical knowledge for teacher education is very restricted. It is used mainly in developing and justifying educational politics and programs. This knowledge is not 'practical' in the sense that prescriptions for classroom behavior can be derived from it. This is one of the main differences with clinical knowledge: clinical principles are, typically, those whose prescriptive value is high.

A valuable implication of Smith's distinction might be that in professional teacher education the greater part of educational theory should be directly related to the teacher's and the pupil's behavior in the classroom situation. He rightly criticizes the emphasizing of 'foundational studies', a type of information which is difficult to relate to classroom behavior. Also worthy of consideration are his ideas about the way in which the relevant concepts should be incorporated into teacher education program.

However, the distinction between clinical and academic knowledge leads to some serious problems. In the first place it seems that the prescriptive potential of clinical knowledge is greatly overrated. The cause-effect relationships that are generally acknowledged to exist are important enough to bring to the student-teacher's attention, but are quite restricted in number and scope and are certainly insufficient as a basis for teaching behavior (cf. section 2.4.).

Even more important, Smith's view leads to an undesirable dichotomization of the results of scientific endeavors that are potentially relevant for teaching: On the one hand, there are educational sociology, educational psychology, etc., being purely descriptive and theoretical. On the other hand, we learn that 'research is the chief source of clinical knowledge', (the other source being 'professional wisdom'), and that these research results should lead to prescriptions for the teacher. Given the fact that in Smith's opinion the distinction between academic knowledge and clinical knowledge "roughly separates what is loosely, if not erroneously, referred to as theory and practice", a curious division results between theory from for instance, educational psychology (being part of academic knowledge) and 'research' (being the main source of clinical knowledge). One suspects that 'research' is conceived here as a rather atheoretical, empiricistic determining of the relationships between variables. This kind of research can, on purely empirical grounds, produce information about 'effective'

variables which together with 'practical wisdom' can subsequently comprise the clinical knowledge that is strived for.

In the present investigation such an approach is rejected. Theory and research are seen as interrelated, existing educational theories giving rise to research endeavors which, subsequently, lead to corrections and adaptations in theory. Although educational theories can differ in the degree to which they have been validated by empirical research, research is seen as essential to them. We are of the opinion that investigations without a solid theoretical basis may produce cause-effect information, but will lead to problems of interpretation because of their lack of theoretical foundation.

Given the fact that in our study we have as a second requirement that 'educational theory' (conceived as a set of coherent statements, pertaining to a part of the educational reality) should concern everyday classroom practice, it follows that two types of educational theory as distinguished by Smith fall outside our scope. In the first place, a number of 'foundational studies', educational philosophy, educational history, etc., which have no direct relationship to the teaching-learning situation are not dealt with. This does not, however, deny the significance of this type of theory, particularly for a better understanding of the school's function in society. In the second place, we will not deal with everything that Smith calls 'professional wisdom' and what recently is mostly termed 'craft knowledge' (cf. section 2.3.2.), although this type of knowledge is also seen as very important. Both types of knowledge, however, are of a different nature than the 'educational theory' that is the subject of the present study.

Finally, some remarks on the prescriptive value of educational theory are in order. Smith makes a sharp distinction between academic (non-prescriptive) and clinical (prescriptive, partly on the basis of research findings) knowledge. Because in our view theory and research are interrelated, we do not make a sharp distinction of that kind. For some theories it holds that, on the basis of research-data, statements about cause-effect relationships are part of it; the latter can have prescriptive meaning for teachers. However, the most important function of educational theory for teachers is seen as its potential to structure aspects (e.g., 'group discussion') of the teaching-learning process in such a way that this leads to a better understanding of this phenomenon by the teachers, enabling them to perform more adequately and thoughtfully. Educational theory can provide a repertoire of concepts for a better, more detailed observation and interpretation of (aspects of) classroom reality. What action, subsequently, is the most suitable one, depends on many circumstances; in the vast majority of cases theory can give no 'prescriptions' for it. These ideas are similar to Doyle's (1985), who states that the teacher's

professionality does not in the first place pertain to rule-driven (theory based) behavior, but to the fact that it "connects knowledge to situations through processes of observation, understanding, analysis, interpretation and decision making". And he continues: "From this perspective research and theory produce not only valid practices, but also concepts, propositions and methods of inquiry, useful in deliberating about teaching problems and practices." We fully agree with this, although in the present study the focus is, unlike Doyle's, on elements and concepts from educational theories that directly pertain to the classroom situation. The aim is not to promote deliberate reflections that stretch over longer time periods, but to incorporate these concepts into teachers' interactive cognitions.

Our ideas about the prescriptive meaning of educational theory do not imply a denial of the value of investigating cause-effect relationships which may be useful for teachers. A number of this type of cause-effect relationships have already been determined in the context of process-product research.
In our view, it is unadvisable to contrast too sharply the process-product and the cognitive paradigms, as was done in the Dutch speaking countries a few years ago (De Corte & Lowyck, 1983; Knoers, 1983; Veenman, 1983; Creemers, 1983). In the first place, adherents of the cognitive approach should emphasize that concentrating on the cognitive variables in no way implies the denial of the value of the process-product paradigm. Secondly, there are a number of possibilities for incorporating cognitively oriented research into the 'larger picture' of the process-product paradigm, interpreting these cognitive variables as 'mediators'. From the cognitively oriented studies, the adherents of the process-product paradigm might adopt the insights about the insufficiency of research and theory for prescribing teacher behavior, and about the alternative functions educational theory can have for teaching and teacher education.
Shulman (1986) likewise warns against forcing a 'choice' between these approaches. He believes that for the social sciences and education the coexistence of different approaches is a natural and quite mature state. Instead of expecting all good from research following a single paradigm, he advocates designing 'hybrid' research programs in which researchers from various research traditions work together. Apart from the question whether this latter recommendation should be followed, it seems unnecessary and unproductive to foster thinking in incompatible contrasts here.

Our ideas about the character of educational theory in teacher education are related to, although not identical to, the ideas of Fenstermacher (1986). In his opinion, the contribution educational research can make to practice lies in the improvement of "practical arguments" in the minds of teachers. In his view, research cannot lead to prescriptions for the

practitioner. In every practical situation there will be a number of additional considerations, like intuitive insight and morality. So, scientific knowledge must be placed in the specific context in which the teacher has to operate and it should improve the 'practical arguments' on which the behavior of the teacher is based. In fact, the practical role of research lies (apart from its worth in its own right) in the improvement of teachers' beliefs.

We agree with mitigating the prescriptive function of educational research data and with considering its main role in affecting teachers' cognitions. However, we doubt whether the results from research endeavors as they are normally presented have the potential to stimulate teachers' reflections on their own belief systems. Unless the scientific knowledge is presented in the form of practical situations, it is doubtful whether the teachers will perceive the information as relevant to their own situations (cf. Kilbourn, 1986). For this reason, we presented the theoretical information in the form of real life classroom situations and in full contextual detail. A second point of difference concerns the sort of cognitive influencing that takes place. In Fenstermacher's view, the 'practical arguments' to be improved seem to have the form of propositional thought, being an element in a line of reasoning and resulting in a well-considered action. Fenstermacher was heavily criticized because of his ideas about the propositional character of teacher thinking (Munby, 1986), and because of the implication that new practices would follow from improvements in the practical arguments of teachers (Russell, 1986). Fenstermacher's ideas seem to imply that teachers' practices will change if particular (logical) arguments for doing so have been brought to their attention. This overestimates the rationality behind teacher behavior. It is doubtful whether information that is presented in propositional form will be of any direct consequence for teaching behavior. In our study we tried to provide teachers with theory-based concepts ('to be seen' in real life classroom situations), not to improve their 'practical arguments', but to extend their repertoire for interpreting classroom events and to improve their ability to make sense out of the classroom situations.

In section 2.5.2 it was indicated that our approach is related to the protocol materials movement, because also there an attempt was made to enhance teachers' interpretative abilities by employing filmed episodes of classroom behavior. However, there are some profound differences that need clarification.

In the first place, the decision to incorporate coherent educational theories into the treatment materials differs from the routine followed in the development of protocol materials. Originally protocols were developed to bridge the gap between theory and practice (cf. Smith, 1969). Despite

this promising starting point, the majority of the protocol materials were not based on coherent educational theories. Instead, most projects focused on more or less isolated concepts, grouped them together and produced protocol films in which a set of concepts was presented and illustrated (cf. National Resource and Dissemination Center, 1978). As early as 1975 Smith had pointed out that the development of protocol materials was a very promising initiative, but (just like the performance-based movement in the development of microteaching materials) lacked a body of valid content to be incorporated into these materials. Characteristic of and essential to our approach is the use of educational theories as the basis of the treatment materials. Our view of the way (student-)teachers should incorporate educational theories is in line with Beck (1983), for example, who states that educational theory should be incorporated into the teachers' cognitive structures. He sees the function of educational theory mainly as a change in the teacher's perception of reality; the teacher becomes 'sensitized for new phenomena'.

The second difference between our approach and the protocol materials movement concerns the way in which the effects of the materials were measured. Given the fact that the protocol materials movement focused on the enhancement of teachers' interpretative abilities, one would expect the emphasis in the evaluation of these materials to be on the question whether a change in teachers' cognitions has taken place. When considering the actual focus of evaluation, however, it appears that in almost all protocol projects there were reports about the opinions of the users (Cooper, 1975), in most of the projects there were reports about the degree to which teachers, having worked through the protocol materials, were able to recognize the concepts (e.g., Gliessman & Pugh, 1976) and in some studies the effects on teacher behavior in the classroom were determined (Kluecker, 1974; Borg, 1977). However, there are no studies in which the most important effect pursued, the effect on teachers' cognitive processes, was investigated. This can probably be explained by the fact that the majority of the investigations in teacher thinking started after the big protocol materials projects were executed. In Chapters 3 and 4 these investigations and the way in which we employed them in the present study to determine the effects of the video-treatment will be discussed.

As will be explained in section 6.1, the first function of the video materials, which is the treatment in this study, is to be a diagnostic evaluation-instrument in teacher education. This instrument can be used to determine whether the student-teacher has mastered the educational theory concerned, in the sense that he or she is able to recognize the theory-elements in concrete classroom situations. All considerations that up to now have been discussed in the present chapter have direct consequences for

the way educational theory should, in our view, be evaluated in teacher education, namely, directly related to classroom situations (cf. Verloop, 1981). For this reason we consider the procedure for evaluation that is presented here an important improvement compared to the usual methods employed for the evaluation of educational theory, which in many cases amount to reproduction of verbal-theoretical knowledge.
Our opinions and choices pertain to the way in which educational theory should be brought to the student-teachers' attention, both in instruction and in evaluation; for this reason these two components were not treated separately in the theoretical considerations that were the subject of the present chapter, (for a more general discussion of evaluation in teacher education cf. Millman, 1981; Gorth & Chernoff, 1985; Haney, Madaus & Kreitzer, 1987; Stiggins & Duke, 1988).

An important choice made in this study of course concerns the decision to do an intervention study. It is noteworthy that of the large number of investigations in the area of teacher cognitions, only a small minority of them are intervention studies (e.g., Tuckwell 1980a; Driscoll et al, 1986), and almost all studies are of a descriptive nature. The choice to do an intervention study is related to the fact that ultimately the focus of this study was to contribute to the development and designing of the teacher education program; the determination of the effects of particular measures (i.e., a particular procedure for transmitting and evaluation of educational theory) was at issue. A purely descriptive study would not have been adequate for that purpose. Focusing on the teacher education program is also of consequence for the way and the detail in which other problems or aspects (e.g., concerning the psychology of learning) are treated in this study. They are only taken into consideration or incorporated into empirical research as far as this will contribute to answering the main research questions.

The interventional character is the most salient, but not the only aspect in which our study differs from the majority of studies in the field of teacher thinking research. According to Clark & Peterson (1986), most of these studies up to now focused on elementary school, left the relationship between, e.g., thought and behavior out of consideration and used experienced teachers as participants in the vast majority of the cases.

3. RESEARCH ON TEACHERS' COGNITIONS

In this chapter research on teachers' cognitions, as far as relevant for the present study, is discussed. A distinction is made between, on the one hand, specific thought processes that are directly related to specific actions, like decision making (section 3.1) and, on the other hand, more general and permanent aspects of teacher cognitions (section 3.2). The latter section is subdivided into general characteristics of expert teachers' cognitions (section 3.2.1) and propositional (not directly action-related) knowledge of teachers about educational phenomena, which is termed 'implicit theories' here (section 3.2.2). In the final section the research on the relationship between cognition and behavior is covered.

3.1 Teachers' thought processes

The fact that this study concerns affecting student-teachers' interactive cognitions not only determines the character of the treatment, but also the way in which the effects of the intervention should be measured. On the basis of these choices this investigation can be placed within the 'cognitive paradigm' in research on teacher education (cf. Clark, 1979; Shulman, 1986). Because the relevant research and theory for this paradigm have already been summarized and reviewed by a number of authors, it will be discussed only briefly here. For more extensive reviews and collections of recent research reports the reader is referred to Shavelson & Stern (1981), Shavelson (1983), Hofer (1981), Clark & Peterson (1986), Ben-Peretz, Bromme & Halkes (1986), Lowyck (1986) and Strømnes & Søvik (1987).

Apart from some precursors, like Jackson (1968, 1971), who published on the mental life of teachers and students during classroom instruction, systematic and detailed investigations into the cognitions of (prospective) teachers rarely took place before the mid-seventies. The early investigations were mostly devoted to planning (Yinger, 1977; Morine, 1976) or interactive teacher cognitions (Morine & Vallance, 1975). During the same years a strong impetus for this kind of research came from some highly influential studies of a more theoretical (Shulman & Elstein, 1975) and programmatic (Gage, 1975) nature.
In one of the earliest publications in which an attempt was made to order the existing literature on teachers' cognitions, Clark (1980) contrasted two models for research on teachers' thinking, namely, decision making models versus information processing models. In the decision making models

the main questions concern the character, frequency and effects of the teacher's preactive and interactive decision making. (For an illuminative account of the various types of teachers' decisions, see Sutcliffe & Whitfield, 1979). Within the information processing models the central questions are 'How does the teacher's information processing capacity limit and influence the ways in which complex task environments are simplified into problem spaces?' and 'How does this influence subsequent teacher thinking, classroom interaction and student learning?'

In the years that followed it appeared that the concept of 'teacher decision making' became a source of continuing disagreement among researchers. The controversy centered around the question whether decision making in the sense of 'choosing between alternatives' was a useful metaphor in describing teachers' interactive decisions. In his review of research on teachers' decision making, Calderhead (1981b) observed that generally teachers make relatively few choices among alternatives, but that instead most of the teachers' decisions concern more or less predetermined responses to configurations of cues. McKay & Marland (1978) concluded that the concept 'deliberate act' would be a better term for what is mostly called 'decision making' in the context of teaching. In their review article, Clark & Peterson (1986) observed that many researchers utilize a definition which is broader than "conscious choice between two or more actions" and includes also "teachers' conscious choice between continuing to behave as before or behave in a different way". Based on this broad definition, research indicates that the frequency of teacher decision making is about every two minutes on the average. Clark & Peterson suggest that a model of teachers' interactive decision making should reflect the definition of decision making as a deliberate choice to implement a specific action (rather than a choice from alternatives) and include other than student factors as evokers of such decisions.

The metaphor of the teacher as a decision maker was heavily criticized by Yinger (1986). In the first place, decision making requires a conscious and deliberate choice (although it may be a choice between continuing a current action or changing it), thereby neglecting all kinds of less conscious, routinized or spontaneous processes. In the second place, it appears from various research studies that teachers' interactive decision making covers no more than 25% of the teachers' reported thoughts. So this metaphor inevitably pertains to only the smaller part of teacher cognitions. Dillard (1987) also stresses the improvisational character of teaching and discusses the limitations of the current models of the teacher as a decision maker.

From the literature mentioned in the beginning of this section it appears that research on teachers' cognitions not only explored the various aspects

of the mental life of teachers, but also that a variety of metaphors like 'problem solving', 'decision making', etc. was employed to describe it, (cf. Yinger, 1987, for a number of characterizations of teachers' skilled interactive practice, which can be found in recent literature). As far as this variety is related to underlying differences in theoretical orientations, it stands for a real danger to this relatively young research area: the danger of continuing fragmentarization of this field into approaches that have increasingly less in common, (for a discussion of this problem cf. Verloop, 1988).

In reviews on teachers' cognitions the investigations are generally ordered into the categories (1) planning, (2) interactive cognitions and (3) implicit theories. Decision making is normally treated under the second category. Teacher 'judgment', which in the earlier studies was treated separately (e.g., Clark & Yinger, 1979), is now seen as a component that can be relevant in every category of teacher cognitions (cf. Clark & Peterson, 1986; Shavelson, 1987).
The focus of our study is the second category: the interactive cognitions of student-teachers. It is striking that during the whole period in which this type of research on teacher cognition has taken place, two approaches were to be discerned. These were as early as 1975 identified by Shulman & Elstein. In their seminal article on investigation procedures of human thought processes, they distinguished between 'process tracing approaches' which attempt to describe the subject's intellectual processes and 'black box investigations', which attempt to model the processing mathematically (e.g., using the Bayesian model or regression modelling) through studies of input-output relations. About a decade later Shavelson et al (1986) used basically the same division in their section on "measurement of teachers' cognitive processes", namely, 'process tracing' and 'regression modelling'. Of course it appears from their review that there has been a number of developments in the elaboration of techniques. It is striking that there is a tendency in process tracing methods to study the person relatively more in ecologically valid environments. Whereas in the Shulman & Elstein study two out of the three groups of techniques that were described as 'process tracing methods' were still devised for more or less artificially contrived situations, Shavelson et al discuss under the heading 'process tracing' successively 'think aloud methods', 'retrospective interview' and 'stimulated recall' methods, that in any case permit use in natural situations (and are used, as it appears from the studies described, in the majority of cases within the context of normally occurring planning and teaching tasks).
Some researchers have tried to integrate these two lines of research, e.g., using policy capturing or self report techniques in the study of teachers'

decision making (Borko & Cadwell, 1980; Borko & Tech, 1982), or comparing self reports with data from a process tracing study (Yinger & Clark, 1983).

Finally, a remark must be made concerning a cognitive variable that could have been included in the present study, viz. the teacher's 'conceptual level' or 'cognitive complexity', roughly indicating the degree of abstractness in the teacher's reasoning, (Mintz & Yarger, 1980; Hukill, 1983; Showers, 1984). It would have been possible to include teachers' cognitive complexity as an alternative explanation for the experimental effects in this study, a role this variable played in the early investigations into the effects of the 'models of teaching' program, (Joyce et al, 1969; Hunt & Joyce, 1967; Shigaki & Brown, 1981). One could imagine that the results of our investigation into teachers' cognitions could to some degree be explained by the teacher's cognitive complexity (cf. Joyce, 1980). The main reason for not including this variable in the present study was a pragmatic one. It was felt that incorporating this kind of variable would extend the investigation too much. We decided to incorporate only those teacher variables that were directly related to their ideas about education and teaching, either in the general sense (cf. section 7.5.3) or pertaining to educational theory (cf. section 7.4).

3.2 Teachers' frames of reference

3.2.1 Expert-novice differences

In the previous chapter one section (2.3.2) was devoted to research on teachers' craft knowledge. The emphasis was on investigations to find out in what way craft knowledge of teachers could be useful for teacher education. Craft knowledge was viewed as a source of information, analogous to information from educational theories.
The present section, in the context of discussing research on teachers' cognitions, treats in the more general sense some recent developments in research on teachers' craft knowledge, and centers on research on differences between experts and novices in this respect. The relationship between this kind of investigation, which is mostly phrased in the terminology of information processing theories, and our own study is indicated.

Recently there has been an enormous increase in interest in the characteristics of expert teachers and the way in which they differ from novices (Berliner, 1986), as well as in specific cognitive aspects of their functioning (Griffey & Housner, 1985; Leinhardt, 1985; Leinhardt, 1986;

Dunn et al, 1987), and the routines of these teachers (Leinhardt, 1983; Olson, 1984; McCaleb et al, 1985).

Almost all authors in this area employ a terminology that is derived from information processing theories. Shavelson (1985) describes teaching activities as "scripts with their characteristic scenes" and indicates that this term is equivalent to "activity structures", a term used by some researchers on teachers' cognitions. A detailed description of the differences between experts and novices, framed in this kind of terminology, was given by Leinhardt & Greeno (1986). They characterize teaching as a complex cognitive skill. Because teaching requires the construction of plans and the making of rapid on-line decisions and because it takes place in a relatively ill-structured dynamic environment, they see similarities to other tasks that have recently been studied, such as medical diagnosis. In their view, a lesson can be subdivided into segments, called 'activity structures' (e.g., 'presentation and review' or 'guided practice'). For each of these segments the teacher has a scheme, on the basis of which he or she can complete this segment of the lesson. Some of the activities have occurred so often that both teacher and student almost automatically perform them; they are 'routinized'. From their research it appeared that one major difference between experts and novices was that novices displayed a constantly changing pattern in how they performed various segments. Because their behavior was rather unpredictable, a lot of time was lost in explaining to the students what would be done in the various segments and what was expected of them.

Peterson & Comeaux (1987) investigated whether differences between experts and novices existed concerning their recall and analysis of problem events during interactive teaching. Building on the scheme-theory from cognitive psychology, they hypothesized that the expert teachers would have better developed knowledge structures or schemata for phenomena related to classroom teaching and learning than novice teachers. It appeared that the expert teachers not only recalled more classroom events from a videotape of classroom scenes, but also analyzed these events at a higher level. The investigators distinguished between level 1, being statements in which the teacher focused on the surface or literal characteristics of a specific classroom event and level 2, being statements that suggested knowledge of higher order or over-arching principles underlying classroom teaching or learning. The expert teachers made significantly more statements which reflected knowledge and analysis of classroom teaching and learning at the higher principle-oriented level 2.

With respect to our own study, which aims at enhancing student-teachers interpretative abilities, enabling them to observe and interpret teaching and learning processes with the help of more general ('level 2') concepts

and principles, it may be said that the treatment of our investigation explicitly centers on the development of student-teachers' expertise; the treatment intends to incorporate the educational theory concepts into the student-teachers' cognitive structures, while the main research question asks whether these theory elements can be detected in the student-teachers' interactive cognitions.

3.2.2 Research on teachers' implicit theories

The cognitions treated in the present section differ from the cognitions covered in section 3.2.1 (and from craft knowledge in general, as discussed in section 2.3.2.) in that teachers' implicit theories are not directly related to teaching behavior, but are propositional in character. Teachers possess a body of knowledge of a propositional character about a variety of educational phenomena, (e.g., 'reading') and about teaching and learning in general. In recent research this body of knowledge is generally termed teachers' "implicit theories", although a range of other terms, with slightly different meanings or connotations, are in use. According to Clark & Peterson (1986), all these terms, like 'principles of practice' or 'personal perspective' are based on the idea "that a teachers's cognitive and other behaviors are guided by and make sense in relation to a personally held system of beliefs, values and principles". We will use the term 'implicit theory' here, although using the theory metaphor does not imply that a theory in the scientific sense is at issue (cf. Bromme, 1984).
It is clear that prior to and during their teaching career teachers will accumulate all kinds of knowledge about teaching and learning and that these notions, whether the teachers are conscious of them or not, can have a profound influence on interactive cognitions and behavior. Meanwhile, a substantial amount of research into teachers' implicit theories is available. In the context of our investigation not only are the studies of practicing teachers (Buchmann, 1980; Kleine & Smith, 1987) of interest, but also the studies on prospective teachers' implicit theories, e.g., Bontempo & Digman (1985) who studied prospective teachers' ideas about teaching, Goodman (1986), who described preservice teachers' perspectives on a number of educationally relevant phenomena and Reighart (1984), who developed an instrument for measuring teachers' beliefs, thereby discriminating directive and non-directive beliefs about teaching. Some researchers concentrate on how teachers manage problematic situations, (Lampert, 1986; Ben-Peretz & Kremer-Hayon, 1986; Van Opdorp et al, 1986), because they believe that these 'dilemmas' are a good opportunity to study teachers' cognitions. For a survey of the research on teachers' implicit theories and the core

problems that are inherent to that type of research see Corporaal, Van Hunen & Kieviet (1984), Mayer (1985) or Taylor (1987).

Information about teachers' implicit theories can be useful for several reasons. The most obvious use that can be made of this kind of information is to take account of it in the teacher education program (cf. Corporaal, 1988). Also Hofer (1983) indicates that in teacher training it is important to link the program to the student-teachers' naive theories. An example of a teacher education curriculum that starts from implicit theories of student-teachers about educational phenomena and tries to articulate these theories through discussion and subsequent confrontation with reality is given by Schley & Redlich (1980).

In the framework of our study the investigation of the student-teachers' implicit theories was interesting for a different reason. This has to do with Mandl & Huber's (1982) observation that teachers' implicit theories have strong self-stabilizing qualities, which makes them very resistant to change on the basis of contradicting information. With respect to our study, this means that elements of educational theories (which were incorporated in the treatment) that are incompatible with the teacher's implicit theory may be quickly eliminated. For this reason it had to be determined to what degree the scores on the dependent variables could be explained by relevant components of the teachers' implicit theories. This meant that the student-teachers' appraisal of the educational theory program had to be determined. The Repertory Grid technique was employed for this purpose. This is a frequently used technique for investigating teachers' implicit theories (Fransella & Bannister, 1977; Pope & Keen, 1981; Rathod, 1982; Van Hunen, 1986). Originally this technique was used in the context of Kelly's personal construct psychology, in order to investigate the relationships between people. An essential characteristic is that a person's ideas about the field under study (e.g., relationships with family and friends) is described with the help of constructs that have two contrasting poles (e.g., intelligent - unintelligent). The details of the application of the technique in the present study are presented in section 7.4.

During the last ten years the application of this technique for depicting teachers' or students' implicit theories has increased enormously (e.g., Munby, 1982; Thomas & Harris-Augstein, 1985; Corporaal, 1988). This reflects the increased interest in the mental life of teachers, combined with a reluctance to impose pre-determined research-based categories on these data. Instead, these investigators place a high value on depicting teachers' implicit theories as much as possible in the teachers' own terminology. It is hoped that in this way distortions on the part of the investigator will be minimized.

In the literature several attempts can be found to classify teachers' general ideas about teaching and learning (as distinguished from their ideas about specific phenomena) into categories. Fox (1983), for example, discerns four 'basic theories of teaching' that he found with teachers: focusing on transfer of knowledge to the passive student, on the shaping of students to a predetermined pattern, on the explanation of subject matter as a collaborative effort by teacher and student and on the development of the student's personality. In the present study the student-teachers' implicit theories about teaching and learning in general (termed "educational philosophies") were explored. It was determined to what degree the educational philosophies of each of the student-teachers could be characterized as being 'in line with' one of the four 'families' of teaching models that were distinguished by Joyce & Weil (1980): information processing, social, personal and behavioral. This might result in differential effects of the experimental treatment. Further details are given in section 7.5.3.

3.3 Cognition and behavior

From the beginning of research into teachers' cognitions the need for a relationship with the behavioral component of teaching has been emphasized. Shavelson & Stern (1981) even considered the possibilities for investigating the relationship between cognition and action as one of the most important justifications for starting research on teachers' cognitions.
The most obvious reason for including behavioral variables in teacher thinking research is that in every investigation one starts from the assumption that the cognition under study will in some way influence the behavior of the teacher. According to Huber & Mandl (1984), all research on teacher cognition is rooted within 'action-theoretical reference systems', meaning that the course and results of actions are to some degree seen as determined by cognitive processes. This is in line with considering the cognitive variables to be 'mediating' the use of behavioral skills, as discussed in section 2.4. Although in our study the main focus of attention was the effects on teachers' cognitions, we felt that it was necessary to also involve teacher behavior and particularly the relationship between behavior and cognition.
In spite of the arguments in favor of investigating cognition and action together (De Corte & Lowyck, 1983; Colker, 1984; Clark & Peterson, 1986), it holds that the vast majority of the research concentrates on a single component. There are, however, some studies in which both cognition and behavior were covered (e.g., Bauch, 1984; Roehler et al, 1987). Roehler found evidence that the detail and coherence of preservice teachers'

knowledge structures about reading and reading instruction were positively associated with good instructional practice. Bauch (1984) investigated the instructional belief systems of elementary classroom teachers about classroom discipline and control. She examined whether there was a relationship with their classroom procedures or instructional strategies. This happened to be the case. She discerned 'controller' teachers and 'relator' teachers. The former type of teachers used fewer teaching strategies, permitted less interaction among students, etc.

Our objection to almost all studies in which the relationship between cognition and action is investigated is that this relationship is determined at a very global level, leading to unspecified and general statements about this relationship. For example, the results from open-ended interviews are related to ratings of success as student-teacher or even to grades in the teacher education program (Lalik & Borko, 1985). Even if a structured interview takes place and teacher behavior is observed in the classroom (McCaleb at al, 1985), no relationship is determined between particular behaviors and particular cognitions.

In the present study we considered it necessary to investigate the relationship between cognition and action not only at the global, correlational level (section 7.3.2 to 7.3.4), but also at the level of the separate behaviors (section 7.3.5).

4. STIMULATED RECALL

4.1 Introduction

One of the most difficult problems in this type of study is to decide in what way teachers' interactive cognitions are to be measured. Because the main hypotheses pertain to the effects of the treatment on the interactive cognitions of the student-teachers, this problem goes to the heart of the study.

A frequently used technique for measuring interactive cognitions in this type of study is 'stimulated recall'. Variants of this technique were used as early as the fifties. Tuckwell (1980c) quotes a definition from 1953 by Bloom, who described stimulated recall as follows: "a subject may be enabled to relive an original situation with vividness and accuracy if he is presented with a large number of cues which occurred during the original situation". A similar definition was given by Marland (1977), who defined stimulated recall as "a branch of introspective methodology in which audio and/or visual records of a subject's past behavior are used to facilitate the subject's recall of the covert mental activity which was occurring simultaneously with the recorded overt behavior".

In sections 6.3 and 7.1 a detailed description of the way stimulated recall was employed in this study is given. In the present chapter the background and context of this technique is discussed.

The controversies that have accompanied the use of this technique are partly parallel to the discussions on introspective techniques in general. In the next section the place of stimulated recall within the larger picture of related techniques will be considered and the validity of this technique in general will be discussed. The subsequent section will treat the use of stimulated recall in teacher thinking research and a number of controversial matters will be discussed. In the final section some applications of this technique in our type of study will be dealt with.

4.2 The status of stimulated recall

Techniques for investigating human cognitions can be ordered according to several criteria. Useful classifications, tailored to research on teachers' cognitions, are those of Wahl (1981) and Huber & Mandl (1982b). Huber & Mandl classify the verbalisation methods (one of these being the method of stimulated recall) on the basis of the criteria 'perspective' (pre-actional, peri-actional and post-actional) and 'degree of structuredness' (high to low). Wahl makes a distinction between techniques that can be used

for investigating teachers' cognitions that are directly related to behavior and techniques for investigating teachers' cognitions that only have an indirect relationship to teaching behavior (e.g., teachers' implicit theories, cf. section 3.2.2.).

Stimulated recall belongs to the group of verbalization-methods that have traditionally been termed introspection or retrospection, which have a long history in psychological research. Employment of these techniques has long been a source of controversy between opponents of it (e.g., Hebb, 1974, who contends that "introspection is theoretically impossible") and adherents (Radford, 1974). In their much cited article, Nisbett & DeCamp Wilson (1977) conclude that there may be little or no direct introspective access to higher order cognitive processes. They contend that possible correct reportings about cognitive processes should not be ascribed to one's own insight into these processes, but to a priori causal theories that everybody has about, for example, the plausibility of a particular stimulus being cause of a given response. They illustrate their assertions with descriptions of experiments in which people's reports about their internal processes could most aptly be interpreted as plausibility judgments. In Nisbett & DeCamp Wilson's opinion, it is likely that when the subjects in their experiments were asked about their cognitive processes, they "did something that felt like introspection", but which was in fact a judgment concerning the most plausible explanation of their behavior. Perhaps people do not even attempt to interrogate their memories on such occasions, but instead "resort in the first instance to a pool of culturally supplied explanations for behavior of the sort in question or, failing in that, begin a search through a network of connotative relations, until they find an explanation that may be adduced as psychologically implying the behavior". Nisbett & DeCamp Wilson were criticized on theoretical and methodological grounds by Smith & Miller (1978), who proved, among other things, that Nisbett & DeCamp Wilson's assertion that people do have access to prior content but not to processes was untenable: if the subject was instructed to report the immediate results of his or her thinking very frequently, the 'density' of intermediate results would become so high that a distinction between 'process' and 'sequence of transformed intermediate results' would become artificial.
In a most influential article Ericsson & Simon (1980) presented an information processing model as a framework for interpreting and discussing different types of introspection and retrospection. They concurrently criticized Nisbett & DeCamp Wilson by showing that in the studies cited by them, the procedures employed could not possibly lead to valid retrospective reports, because either it was principally possible for the subjects to generate answers without consulting their memories or the

information requested had never been in memory at all. Ericsson & Simon proved that the results obtained in the studies covered by Nisbett & DeCamp Wilson were consistent with their own model. Ericsson & Simon start from a model of human information processing that, in their later monograph on the same subject (Ericsson & Simon, 1984), they describe as "simple and robust", summarizing "the core that is common to most current information processing theories of cognition". The basic assumption is that any verbalization of the cognitive process is based on a subset of either short term or long term memory. In the former case only the most recently heeded information is accessible directly. In the latter case retrieval is possible under certain conditions and with a certain degree of distortion. Using this basic model, Ericsson & Simon discuss what can reliably be reported during verbalization tasks. They distinguish three levels of verbalization, characterized by increasing effects of intervening (re-coding) processes between cognition and verbalization. The higher the level, the more problems with the validity of the reporting can be expected. Although stimulated recall is not treated here as a separate verbalization technique, some inferences can be made that are directly relevant to our investigation.

In the first place it is clear that giving too specific probes is a threat to obtaining valid retrospective information. Because it is unclear whether these specific probes match the information the subjects have directly accessible, there is the danger that these probes may force the subjects to intermediate and inferential processing and hence produce invalid verbal reports. Giving more general probes can preclude asking for information that was not at all heeded by the individual during the activity (making it senseless to start a 'retrieval' from long term memory).

In the second place it is clearly implied by this model that the investigator should focus on thought processes that occurred during specific behaviors, (because Ericsson & Simon have mostly experimental work in mind here, they talk about "particular trials"). If information is requested that pertains to a longer period of time, a variety of inference and memory processes might in the meantime be involved in producing the verbal reports. This means that during stimulated recall attention should be centered on specific behaviors.

In the present study the stimulated recall procedure was devised in accordance with these two requirements (cf. section 6.3.3).

Shavelson, Webb & Burstein (1986) treat stimulated recall as one of the 'process tracing methods' (cf. section 3.1) for measuring teachers' cognitions. Following Ericsson & Simon's work, they distinguish four dimensions along which process tracing methods vary: time (concurrent reporting versus retrospection), form of the information (verbal versus

nonverbal), demands placed on the respondent (information normally available or not) and breadth of the event reported (the cognition referring to a specific event versus to more general information over a longer period of time). As we saw, Ericsson & Simon indicated in which cases more or less complete and undistorted retrieval of information may be expected. Having placed elicitation techniques such as 'thinking aloud', 'retrospective interview' and 'stimulated recall' on these dimensions, Ericsson & Simon's theory makes it possible to estimate the validity of these techniques. Stimulated recall can be characterized as a retrospective technique based on extensive retrieval cues for retrieving specific events. Especially the richness of the retrieval cues (normally videotapes of classroom events) makes it possible to improve the search of long term memory. Because the information in any case comes from long term memory (after all, it does not pertain to concurrent thought processes), it will almost certainly be incomplete. Following Ericsson & Simon, Shavelson et al contend that the degree of distortion in the information reported "depends on the nature of the probes used by the researcher". If the researcher asks for specific information not normally available, this might require the teacher to search for specific information not normally heeded, thereby distorting the thought processes being reported. On the other hand, confining oneself to a general probe like 'What were you thinking at that point?' does not ask the teacher to report information not normally available. Because this kind of probe was used in our study and because the researcher was very reticent during the stimulated recall interview (cf. sections 6.3.3 and 7.1), it may, on the basis of the theoretical model just discussed, be assumed that no major distortions in the information reported have occurred.

4.3 Problems with stimulated recall in research on teachers' interactive cognitions

In this section we will leave aside the problems that are in general typical of this kind of research (cf. Bromme & Homberg, 1980; Huber & Mandl, 1982c; Calderhead, 1986), and instead concentrate on the validity of the stimulated recall procedure in the study of teachers' interactive cognitions. The major difficulties that arise in this kind of application were concisely summarized by Calderhead (1981a). He defines stimulated recall as "the use of audiotapes or videotapes of skilled behavior, which are used to aid a participant's recall of his thought processes at the time of that behavior." Among the factors that might threaten the validity of the method are (1) anxiety of the participants to report about their interactive cognitions, (2) limitations caused by the fact that some kinds

of information are difficult or impossible to recall introspectively, and (3) distortions caused by the way the investigator prepares the participants for the stimulated recall interview or proceeds during the interview.

The first factor was assumed to be of minor importance in the present study. In contrast to stimulated recall interviews in, for instance, psychotherapeutic settings, the interview about the lesson given by the student-teachers was considered not to be so threatening for them that this would lead to distortions. Before the interview it was explicitly stated that neither the teacher educators nor the cooperating teacher would be informed about the results of the stimulated recall. After the session it was explicitly asked whether during the interview the student-teachers dared to verbalize all the thoughts that "went through their heads" while teaching.

The second group of factors were extensively discussed in the previous section. At this time, it can be stated that those recall problems are to some degree related to the fact that part of the classroom behavior may be automatized through experience, which is of course less at issue with prospective teachers. One might expect that because of the fact that for student-teachers not much routinization can have taken place, stimulated recall can be relatively successful and appropriate. In general it holds that stimulated recall and thinking aloud techniques are quite often used for tasks that are relatively new and interesting (Weidle & Wagner, 1982).

The third group of problems mentioned by Calderhead is partially related to the second one. As a general rule it can be said that in this study it was tried to be as reticent as possible and not to impose a 'model' of any kind during the stimulated recall interview. Calderhead as an alternative strategy proposes giving the teacher theory-based cues during the interview, deriving for every individual teacher a model from the teacher's own commentaries, in order to guide future communication during that interview. Although this is an interesting idea, it raises many obstacles if one wants to make comparisons among the data of a number of participants.

In this context it is important to remember that in most of the investigations reported in the literature, the investigator was far less reticent than in the present study. In the Marland (1977) study, for instance, the investigator took a relatively large share of the conversation during stimulated recall, ranging from 8% to 24% of the total amount of information. In that same study the percentage of discussions that were started by the investigator (rather than by the teacher) during the stimulated recall interview ranged from 9.3 to 61.5, with an average of 29.7. One could wonder what kind and amount of distortion could be induced by this behavior.

The stimulated recall method was heavily criticized in a provocative and well-documented article by Yinger (1986). Because this critique goes to the heart of the stimulated recall method (employed the way it was in the present study), it will be treated in some detail here. Yinger rightly observes that researchers who use stimulated recall not only make the claim that stimulated recall promotes recall of what was said and done during the action, but also that it allows the participant to remember what he or she was thinking at that time. After discussing the work of Ericsson & Simon, who determined under what conditions verbal reports can be expected to be valid and trustworthy (cf. section 4.2), he concluded that the stimulated recall situation was not covered by Ericsson & Simon: in none of their conditions was the subject re-supplied with a set of cues that are supposed to be similar to those in the original situation. Based on the work of Ericsson & Simon, Yinger developed his own model of retrospective reporting. His main critique pertains to the fact that researchers using stimulated recall assume that the new cues (i.e., the videotape) are isomorphic to the original ones and allow the subject to retrieve information residing in long term memory, related to the original event (i.e., the lesson given). He argues that, instead, the videotape creates a new event that is only 'related to' the original event. In his opinion, this relationship is of such a nature that it is not warranted to use stimulated recall in the way it has up to now been done on a large scale during research on teacher cognitions.

The most obvious objection against Yinger's definition of the viewing of the videotape as a 'new event' is that undergoing the videotape as a 'new event' would cost the viewer more time and energy than 'reliving' the original experience while viewing the tape, (the latter being the claim of those using the stimulated recall method). It should be kept in mind that normally a well-designed stimulated recall procedure requires rapid cognitive processing from the teachers, in which there will hardly be time for reflection. Unless the teachers have the impression that reflection is required (we will return to this shortly), it is much easier for them to immerse themselves again in the classroom situation, which is visible on the screen (and which was reality one or two hours earlier) and to externalize directly the specific cognitions, than to stand back from the matters that are shown on videotape and to report their impressions in the more general sense (as if it concerned 'new' material). Given the fact that both options are possible, (also in Yinger's view: "the stimulated recall interview may actually stimulate recall; it is impossible, however, to know what is really taking place") one would expect the teacher to choose the option which, under the pressure of time, requires the least cognitive energy. So, in our view Yinger's assertion that "the major task of the stimulated recall interview is to understand and interpret (making sense

of) one's past behavior as represented on the tape", ignores the fact that during a properly executed stimulated recall interview there is hardly any time for reflection.

According to Yinger, there are three sets of evidence that lend support to his model, and so confirm his critique of the stimulated recall method. We will treat them successively.

The first set of evidence pertains to the fact that during the stimulated recall teachers notice things on the videotape which they did not notice during the lesson, especially concerning their mannerisms, etc., and report this in the stimulated recall session. In our view, this fact simply indicates that there are more cues available from the videotape than in the original situation, especially concerning the teacher's own appearance. These cues can also be seen as 'additional to' the cues available in the original situation. It is quite natural that the teacher, while viewing the tape, will notice this information, but it is not at all obvious that this will prevent him or her from experiencing the cognitions that were present during the original situation. Provided with proper instructions, the teacher will know that these additional cues are not relevant to the task at hand. The question is not whether the cues in the stimulated recall situation are identical to the ones in the original situation, but whether the cues in the stimulated recall situation are sufficient to perform the task at hand.

The second set of evidence supposed to support Yinger's model is also related to the teacher's reports during the stimulated recall interview. In the first place Yinger observes that much talk produced during the stimulated recall interview is in the present tense, teachers saying things like "I am thinking..." instead of "I was thinking...". Quite contrary to Yinger's interpretation of this phenomenon, we consider this to be evidence for the fact that this teacher is, with the help of the videotape, 'reliving' the original situation and is, quite naturally, reporting about it 'as if' he or she is experiencing it at the very moment. In the second place Yinger observes that in many stimulated recall interviews teachers often branch into reasons and explanations, only generally related to the specific event. Indeed, in transcripts of stimulated recall interviews provided in Yinger's article, it can be seen that the teachers talk about their beliefs, etc., in the general sense. When reading most of the transcripts of these interviews, however, we cannot get away from the impression that for many teachers it was unclear what exactly was expected from them. It should be kept in mind that normally for teachers 'discussing their lesson' involves talking about it in an evaluative way and, particularly, justifying and explaining the reasons for their behavior. Unless they get clear and specific instructions, the teachers will almost certainly take for granted that the stimulated recall interview is meant to

produce this kind of information. Matters are even more complicated, because in some cases stimulated recall interviews have indeed purposely been used to obtain this kind of information (e.g., by Marland, 1977; Tuckwell, 1980a). As appeared from our own study, giving very specific instructions before the stimulated recall interview plus, if necessary, asking an additional question about the interactive nature of the teacher utterance during the interview, (cf. section 6.3.3), combined with moving the interview along at a fast pace (leading to a high cognitive load to perform the externalization procedure) resulted in stimulated recall data in which these kinds of general reflections were almost absent.

The third set of evidence supporting Yinger's critique pertains to the questions researchers have asked teachers to respond to during the stimulated recall interview. Yinger lists a number of these questions and proves that these questions introduce error, because the information asked for was probably not available in the teacher's mind during the original situation, ("Why were you acting in that way?"; "Did you have any particular objectives in mind in this segment? If so, what were they?", etc.) or because they could be easily answered from observation, ("What were you doing?"; "How are the students responding?", etc). In general, asking specific questions leads to channelling the teacher's attention to specific topics. We fully agree with the points made here. However, we do not consider asking this kind of dubious question to be inherent to the stimulated recall method. Instead of discarding this method as invalid on the basis of this evidence, we would suggest avoiding this type of question and confining oneself to the core question of the stimulated recall interview "What did you think?" None of the four questions that were allowed during the stimulated recall interview in the present study (cf. section 6.3.3) could induce the types of error discussed by Yinger here.

Our general conclusion is that Yinger has indeed pointed to a number of problems that must be solved when the stimulated recall method is used, but that he has not proven that this method is basically invalid for obtaining information about teachers' interactive cognitions.

In the preceding part of this section the main validity problems of the stimulated recall method for eliciting teachers' interactive cognitions have been discussed. There is one more problem that needs attention. This point was most plainly raised by Munby (1982). While discussing the importance of investigating teachers' beliefs in research on teaching in general, he, on the basis of a review of a number of stimulated recall studies, challenged researchers' assumptions that the meanings they attached to the various categories of their coding system were identical to the meanings the teachers attached to them. He states that unless one has knowledge of the belief system of a particular teacher, one never knows

whether a teacher utterance during stimulated recall should be coded as pertaining to 'objectives', 'subject matter', 'instructional process', et cetera.

Apart from the fact that this problem always arises when a researcher codes verbal data from respondents, whether this problem is complex or not strongly depends upon the nature of the categories into which the data are coded. As a rule it can be said that the more general the nature of the categories and the more these categories are termed in 'common sense language', the greater the chance that the meaning attached to it will not be unequivocal. In our study the categories were of a very specific nature, viz., directly related to the elements from the educational theories, which in fact dictated the meanings to be attached to the categories. Besides, many investigations into teachers' cognitions do not exclusively focus on fully conscious and well-defined cognitions. In such cases a teacher utterance would not be identified as referring to, e.g., 'objectives' by the teacher himself (because the teacher was too concentrated on the content of it or, even more probably, because things went too fast), while the researcher rightly codes it as such. We also had this situation in our study: the coder determined whether the various theory-elements could be discerned in the stimulated recall data. Here the problem was even less at issue because attention was focused on the differences between the experimental groups: any distortions of this kind that might have occurred were in operation for all groups, having no effects on the differences between them.

4.4 Applications

During the last 15 years stimulated recall has been employed in a number of studies to elicit teachers' interactive cognitions. In their review chapter, Clark & Peterson (1986) list 12 studies in which stimulated recall was used and they discuss the general characteristics and findings from these studies. For example, it appears that on the average only a small portion (about 14%) of teachers' interactive thoughts deal with instructional objectives. In all 12 studies, coding was done by placing the teacher's utterances into a category system, followed by counting the number of thoughts in the categories and making comparisons (cf. Verloop, 1984). In this respect Tuckwell's (1980b) remark is relevant: as a rule, the categories in this type of investigation largely establish the unit of analysis. Further relevant problems and choices concerning the coding procedure will be discussed in section 7.1.3. (For a discussion of the various types of content analysis on this sort of data, see Huber & Mandl, 1982c).

Morine-Dershimer (1984; 1986) experimented with several 'alternative' procedures for analyzing stimulated recall data. One of these procedures concerned determining a kind of 'profile' for every teacher, depicting which categories of the coding system were typical of that teacher. The other two alternative procedures concerned the complexity of teachers' interactive cognitions, based mainly on the degree to which sequences in teachers' cognitions could be established, and 'imagery' in their thinking, based on their using of metaphors. Elements of these ideas were used in the present study (cf. section 7.1.4.5).

In the beginning years of investigation into teachers' thought processes, a number of related studies were executed at the university of Alberta by Marland (1977), Conners (1978a), Cooper (1979) and Tuckwell (1980a), which also influenced the stimulated recall procedure that was followed in the present study. All of them used stimulated recall as a technique for eliciting teachers' interactive cognitions. In all four studies these cognitions were measured in a very detailed way, using small samples of teachers, (in the four studies mentioned the sample sizes were 6, 9, 4 and 2 respectively). The main difference between the present study and these four investigations lies in the categories that were used to analyze the stimulated recall data. Whereas in the present study the categories were derived from educational theories, the categories of these four studies are (with the exception of the Conners study in which also teachers' beliefs, principles and values were involved, albeit at a very general level), partly based on common sense ideas about what might be important aspects of teacher cognitions and for the other part are loosely related to information processing theory in general ('perceptions', 'interpretations', 'prospective tactical deliberations', etc). Even in the only study (Tuckwell, 1980a) that investigated the effects of an intervention program (viz., an inservice training program), it is unclear what the relationship is between this intervention program and the categories that are used for analyzing the stimulated recall data. The intervention program is described only very superficially. Also here the stimulated recall categories are of a very general nature and it is hardly surprising that no effects of this intervention program were found. Even when observation of teachers' overt behavior took place, this was done at a very global level. None of the studies (and none of the other investigations we found) examined in detail the relationship between particular behaviors and particular cognitions (cf. section 3.3.).

Another early study on teachers' preactive and interactive cognitions that influenced the way in which the present investigation was devised was done by Lowyck (1978). Starting from the definition of teaching as an intentional and complex activity, he employed various forms of retrospection in order to depict essential characteristics of teachers' cognitive processes.

Concepts from information processing theories were used for labeling these processes. Typical of this study is a strong concern against fragmentization of the teaching process into isolated components and a search for an organizing framework.

From the literature it appears that stimulated recall has been used for various purposes. At some teacher training institutions it is employed as part of the regular training, mainly because of its potential for promoting awareness of one's cognitive and affective processes (Wagner, 1983).
McConnell (1985) used stimulated recall for evaluating the quality of science videotape materials, letting students recall the thoughts that had occurred to them at the first viewing of these materials.
Using stimulated recall for eliciting pupils' (instead of teachers') thoughts has not frequently been done, although some studies are available (Wagner et al, 1977; Cooper, 1979; Marland & Edwards 1986).

We will not discuss all kinds of practical directions that can be derived from the employment of this technique in the various investigations. Many still very useful recommendations for conducting a stimulated recall study were given by Conners (1978b). An exception will be made for one problem, which is frequently underestimated, namely the importance of understanding the context of teacher utterances by those who are to code the stimulated recall data. In our study the coding of the stimulated recall data took place with the permanent availability of the videotape data of the lesson that was at issue. Earlier investigations revealed that a lack of knowledge of the particular lesson severely hampered the coders' understanding of the stimulated recall data. Marland (1977) observed that: "A fuller appreciation of the meaning of the interactive data could have been achieved by the coders through time consuming observation and study of the videotapes of lessons used in the stimulated recall interviews, a procedure which could not be used because of time constraints and because it would have constituted an infringement of the guarantee of anonymity for participating teachers." In the present study we did not feel that videotape observation by a coder (who was not personally known to the student-teachers) was unwarranted with respect to anonymity.
It is our conviction that accurate coding of the stimulated recall data is hardly possible without the permanent availability of the related videotape data.

5. MAIN RESEARCH QUESTIONS

Only the main research questions are presented in this chapter. More detailed research questions will be discussed when the design and procedure of this investigation have been presented (section 6.4).

It is important to note that, preceding the study proper, much time and effort was spent on developing video materials that had the function of treatment materials in this investigation. As this sort of instrument was not yet available, the first years of the project were spent on developing an instrument for measuring teachers' ability to recognize educational theories in real teaching-episodes, in line with the "cognitive tradition" described in Chapter 2. Because of the labor-intensive nature of this development-process, the study proper could not start before this process, which took two years, was completed. Both the development process and the final results are extensively described in section 6.1. The reliability, validity and feasibility are also discussed and reported in section 6.1.
This construction of the materials was prior to and conditional to posing the general question of this study: what is the influence of using these materials on subsequent interactive teacher cognitions and on related teacher variables? Or, phrased otherwise: is it possible to construct these materials in such a way that using them influences subsequent interactive cognitions and related teacher variables? The question may be considered the very heart of the investigation presented here. From section 6.2 and on the report focuses on the effects of using the video materials. For this reason the video materials are consistently indicated as "treatment materials". The rest of this chapter will also be devoted to (the specifying of) this question.

The question mentioned above can be analyzed into a number of more specific questions. Questions a to e will be termed the "main questions" of this investigation. Each of them will be treated under a separate heading here. The sequence a through e reflects the order of priority:

a Does the experimental treatment have any influence on the use of educational theory in subsequent interactive thinking?

b Does the experimental treatment have any influence on the use of educational theory in subsequent interactive teaching behavior?

c If there is any influence of the experimental treatment on teachers'*)

*) For the sake of brevity, in the empirical part of the study 'teacher' is used instead of student-teacher.

interactive thinking and on interactive teaching behavior, how are these cognitions and actions related?

d What is the relative influence of teachers' appraisal of educational theory (taught during teacher training) on their use of educational theory in cognition and action, compared to the influence of the experimental treatment?

In addition to these questions a number of other topics will be treated in this study. Compared to the questions a through d these topics are not treated in depth. They are brought together under the next point:

e The predictability of teachers' interactive thoughts and interactive behavior from their scores on the video-instrument.
The influence of the experimental treatment on teachers' lesson planning.
The relationship between teachers' educational philosophies and their use of educational theories in their cognitions and actions.
Teachers' opinions about their own lessons and about the investigation procedure.

It is important to notice that these questions have to be answered twice: once for the Advance Organizer Model and once for the Role Playing Model. An additional issue, relevant to all research questions formulated here, concerns the comparison between the Advance Organizer data and the Role Playing data. Although two data-sets are available for each research question, the singular will be used in all formulations here.

In the following sections the main questions are discussed at a global level. On the basis of the information presented in section 6.1 to 6.3, every main question is subdivided into questions of a more detailed nature in section 6.4.
The analyses of the data gathered to answer the research questions and the results of these analyses for each question are reported in a separate section. Sections 7.1, 7.2, 7.3, 7.4 and 7.5 are parallel to the headings a, b, c, d and e respectively.

Ad a. Influence of treatment on teacher cognitions

In line with the discussion in Chapter 2 and 3 about the function of educational theory for enhancing teachers' interpretative abilities, attention will primarily be focused upon the influence of the materials on teachers' cognitions. The way in which teachers' interactive thoughts were measured adheres to recent developments in this field. In Chapter 4 the use of stimulated recall was discussed. By means of stimulated recall, immediately

after termination of the lesson, an attempt was made to determine to what degree educational theories play a role in teachers' interactive thoughts. Stimulated recall data consisted of audiotaped teacher utterances (recorded while viewing his or her own lesson on videotape).

The key question is: Is the role of educational theory a more prominent one in the interactive cognitions of teachers who got the video-treatment, compared to teachers who did not get that treatment?
There were three experimental groups: one group studied the educational theory and worked through the treatment-videotape (Theory & Tape, TT-group), one group only studied the educational theory (Theory, T-group) and one group got no specific treatment (Control, C-group). The ultimate goal was to influence teacher cognitions, especially those cognitions that play a role in interactive teaching. If this appeared to be possible, our protocol-like materials based on educational theory could have a function encompassing much more than checking teachers' understanding of educational theory.
The potential of influencing teachers' interactive cognitions would give an important additional value to our video materials.
Besides, uncovering theory-related cognitions could be relevant for the investigation of the relationship between treatment and theory-related behaviors in the classroom.

It is clear that these questions could be posed about many educational theories. Because two educational theories are involved in this investigation (cf. section 6.1.1.3.) all questions apply to these two theories. The relationship with some other relevant variables, like the size of the class, was also investigated.

The investigation of teacher cognitions focused on cognitions as revealed by stimulated recall data. The general hypothesis was that theory-related cognitions would be the most prominent and explicit in the TT-group. For further details see section 6.4 and section 7.1.

Ad b. Influence of treatment on teacher behavior

In Chapter 2 some studies were discussed in which the influence of protocol materials on teaching behavior was investigated. It turned out that in a number of cases protocol materials, although not designed to influence classroom behavior, did in fact have considerable influence.
The influence of the treatment materials on classroom behavior was also investigated in this study. The hypothesis is that theory elements will be

found to the highest degree in the classroom behavior of teachers who worked through both the theory and videotape, followed by teachers who worked through the theory only, followed by the control group.

Because the main focus of the treatment was improving teachers' interpretative abilities (cf. Chapter 2), the effects on teacher behavior were considered less important than the effects on teacher cognitions. However, on the basis of the generally accepted relationship between cognition and action and particularly on the basis of the reseach results on the effects of protocol materials, it might be expected that effects would not be confined to cognitions only. Teacher educators in particular will be interested in effects on teacher behavior. If it could be determined that behavioral effects could be brought about without time-consuming and awkward organizational measures, but instead can be achieved by the sort of treatment presented here, this could be very important for teacher training programs.
There was no need for additional data gathering to answer this research question. Since all 60 lessons had been videotaped, these same videotapes could be used to analyze classroom behavior.

During a number of try-outs a detailed prescription-system was developed for coding the videotapes. The purpose of this system was to give directions for ascertaining which teacher behavior could be considered "in accordance with" the relevant educational theory. A description of the ways in which each theory element could be recognised in concrete classroom behavior was given.
Also here the relationship between the variables under consideration and a number of additional relevant variables was investigated.

Ad c. Relationship between behavior and cognition

Because up to this point the data from the stimulated recall and the data from teacher behavior were analyzed separately, the question arises of the relationship between teachers' interactive thoughts and teachers' interactive behavior, as far as the theories under consideration are concerned.
The basic hypothesis is that the T & T treatment induces a more insightful understanding of the educational theory, showing directly how the theory "works" in practice. This might result in a more deliberate application of this theory in practice (cf. section 2.5.2), just because of the fact that the gap between theory (thought) and practice (behavior) is smaller here. If this is the case, the relationship between behavior and cognition will

be strongest for the TT-group, followed by the T-group, followed by the C-group.

At the most superficial level one can determine the correlation between the degree to which theory elements play a role in teacher cognitions on the one hand and the degree to which theory elements can be seen in teacher behavior on the other hand.
At a more detailed level one can interrogate the teachers about the "importance" of particular, theory-related, interactive thoughts (uttered during stimulated recall). "Importance" here refers to the influence of that thought on subsequent interactive behavior. One can, however, question whether the teacher really has access to this sort of information, and whether this procedure does not provoke post hoc rationalizations. It is much more interesting to make direct comparisons between particular interactive teacher behaviors and reported teacher cognitions. It is assumed that a relationship between cognition and action will appear from the fact that a theory-related interactive behavior will be "accompanied by" a theory-related thought. The notion "accompanied by" will be more or less strictly defined.
The general hypothesis is that in the TT-group the number of theory-related behaviors that are accompanied by appropriate theory-related cognitions (i.e., cognitions referring to the same theory element) will be proportionally highest. Testing this hypothesis requires, among other things, a meticulous comparison between the teacher behavior data (videotape of each lesson) and the stimulated recall data of that lesson.

Ad d. Teachers' appraisal of educational theory

The general hypothesis of this investigation concerns the effects of the experimental treatment on teachers' use of educational theory. However, an alternative hypothesis for explaining possible differences in the use of educational theories might be the teachers' appreciation of educational theory in general. It is conceivable that those teachers that put a high value on educational theory (as received at the teachers' college) are more inclined to use those theories in their own teaching (both cognitively and behaviorally). In that case one would hypothesize a positive correlation between teachers' appraisal of educational theory (especially those aspects of educational theory pertaining to teaching methods) and the number of theory-related cognitions in their stimulated recall or the number of their theory-related interactive teaching behaviors.
In order to measure teachers' appraisal of educational theory, the teacher training program on educational theory was subdivided into 21 elements. All

teachers rated all elements on 15 criteria (like 'was this element helpful for better understanding the pupils?'). The 21 elements were determined in collaboration with the teacher educators.
These data not only made it possible to estimate the relative influence of teachers' appraisal of educational theory (compared to the influence of the experimental treatment) on the dependent variables (i.e., stimulated recall data and behavioral data), but also to answer a number of additional questions concerning teachers' opinions about educational theory. Multidimensional scaling on the rating data, for example, can depict the structure behind the teachers' opinions, thereby reducing the enormous amount of data to some implicit criteria that teachers may have in mind while thinking or talking about 'educational theory'.

Ad e. Additional research questions

These research questions are rather heterogeneous and refer to less important aspects of the investigation. They can more aptly be discussed in section 6.4, after the design of the investigation has been presented.

6. METHOD

6.1 Treatment materials

6.1.1 Choice of the educational theories

From the very beginning it was clear that choices had to be made regarding the construction of the treatment materials. The "educational theory in teacher training" comprises a quite diverse collection of theories, insights, notions, etc. Some of these hardly deserve the name "theory" in the classical sense of the word. These matters were already discussed in Chapter 2.
It was decided to confine instrument-construction to two educational theories. Concerning the problem which two educational theories to choose, it is important to stress the rather arbitrary nature of the choices made. The focus of this investigation was to find out whether it was possible to include educational theories into instruments of a well-defined character and, subsequently, to determine the effects of this sort of instrument. So, the main research questions have to do with the didactics of teacher training. They pertain to the nature of the instruments. Principally, many educational theories can function as "content" for this sort of instrument, even if the criteria discussed in the next section are imposed. The choices eventually made are no indication of the value attached to these theories by the researcher, compared to other theories. The final choice was made in collaboration with the participating teacher educators.

6.1.1.1 Criteria for selection

From pragmatic considerations and from the theoretical starting points discussed in Chapter 2, it followed that the educational theories chosen had to meet a number of criteria:

1 The theory had to pertain to real-life classroom situations. A substantial part of the theory presented under the heading of "educational theory" in teacher education bears upon general theoretical notions in the fields of, for example, developmental psychology or general psychology. Statements about observable classroom behavior are often lacking in these theories, or they can only be derived in a cumbersome way. A requirement for the theories to be chosen was the direct relationship to observable behavior of the teacher.
2 It was expected that "translating" theories focused on affections or

attitudes into our instruments would be difficult, compared to translating cognition-focused theories. Thus, in order to explore the applicability of the translation procedure, the treatment materials should preferably have a wider scope than the purely cognitive.

3 The treatment materials had to refer to more or less coherent theories, and not to common sense rules for classroom behavior (cf. Chapter 2).

4 The classroom behavior exposed in the instrument should not be too far away from the "normal" classroom behavior of the average teacher. The materials would be worthless if the average teacher estimates the exposed classroom behavior as unrealistic.

5 The theories chosen had to be applicable to a number of subjects. This criterion relates to the choice for educational theories in the general sense. When, as in the present case, there is hardly any experience with a type of instrument, it seems sensible not to focus on one subject field too early. Instead, it seemed wise to first investigate applicability in a more general sense. Especially the collaborating teacher educators insisted on this approach. Obviously, a choice of this kind can be challenged. In the selection process it meant that subject-specific theories did not come into consideration.

6 For the same reason (broad applicability), the theories chosen had to be suited for the widest possible range of ages.

7 A more pragmatic criterion concerned the question to what degree a theory has already been "translated" into concrete classroom behavior by others. In the past some researchers have tried to indicate how several educational theories can be transposed into everyday classroom behavior. Adhering to this tradition could lead to a saving of time. As indicated in Chapter 2, it is mainly the "models of teaching" movement that comes to mind in this context.

6.1.1.2 Models of teaching as translations of theory

The models of teaching movement was more extensively discussed in Chapter 2 where it was stated that some results of this tradition would be used for the development of the treatment materials. In this tradition much creativity has been invested in "translating" educational theories into day-to-day classroom behavior. The results meet the criteria described in the previous section to a satisfactory degree.

In this context the label "model" is not at all unequivocal. The best grasp of the meaning attached to the word "model" results from examination of the models that are described in the literature. In the present research some of the findings of Joyce & Weil, the best-known representatives of this

approach, will be used. Joyce & Weil (1980) define a model of teaching as "a plan or pattern that can be used to shape curriculums (long-term courses of studies), to design instructional materials, and to guide instruction in the classroom and other settings". They divide the 22 models presented into four groups: information processing models (e.g., the Inquiry Training Model, the Advance Organizer Model), personal models (e.g., Nondirective Teaching), social models (e.g., Social Simulation, Role Playing) and behavioral models (e.g., Behavior Modification).

Stallings (1977) also described a number of Models of Teaching; she elaborated five models in detail. An extensive account of models of teaching, leaning heavily on the work of Joyce & Weil, can be found in Eggen, Kauchak & Harder (1979). Brady (1985) published a thorough description of 5 models. Some authors strictly adhere to models for attaining cognitive objectives. Others also include models for attaining non-cognitive goals.

As appears from the definition of Joyce & Weil, for example, the word "model" can be used to refer to the "codified" curriculum or to instruction in the more general sense. In the present research the latter meaning of the word will be used. A model is conceived here as a coherent set of measures to shape the instructional process. The coherence results from the fact that all measures are based on a particular educational theory. This fact is regarded essential in the present study. Indeed, the relation to educational theories has been constantly in the focus of attention in the "models of teaching" movement, (cf. section 2.4). Depending on the "breadth" of the theory on which it is based and on the goals that are strived for at a particular moment, a model of teaching can be manifest in a part of the lesson (e.g., the occasional learning of a new concept, using Bruner's theory on concept attainment) or in an extended sequence of lessons (e.g., the Group Investigation Model, based on Thelen's theory).

It is important to notice that a model of teaching in this sense has general applicability; it is not confined to one type of lesson content. In this respect it is different from domain-referenced elaboration on particular theories of human information processing that describe detailed theory-based procedures for particular tasks.

Not being confined to particular content is both the strength and the weakness of the models of teaching approach. Once a teacher has mastered a particular model, he or she can employ it in a great variety of situations. On the other hand, these sorts of applications will almost inevitably require specific adaptations to the lesson content that is at issue. That teachers are essentially capable of doing this has, for that matter, been proven in a number of studies (e.g., Joyce, Weil & Wald, 1973). Conditional to this capability is, in the first place, a clear notion of the theory on which the model is based and, in the second place, a clear view on the

steps that have to be followed in the lesson when applying that model.
In this study the theory is brought to the student-teachers' attention by a written text and by discussing that text with the teacher educator (cf. section 6.1.7).
The video-instrument confronts the student-teachers with a number of lesson episodes in which theory elements have been incorporated on a step-by-step basis. It could be argued that the word "model" refers mainly to the (theory-bound) procedure that has to be followed by the teacher. Maybe the word "strategy", used in our Dutch version of Joyce & Weil's publication (1989), is a better indication of the meaning of the concept.
There is one potential misunderstanding that needs clarification here. Application of a model of teaching never fully determines the classroom situation or teacher behavior. A model indicates a number of measures that have to be taken by the teacher (resulting in the "application" of that related theory, and consequently, resulting in the pupils' achieving the goals for which this particular theory can be helpful). These measures must be observable in the classroom situation. There are, however, apart from these measures, a number of other determinants of teacher behavior in the classroom, such as characteristics of these particular pupils, common sense ideas about desirable behavior, physical conditions and limitations, the teacher's implicit theories and the teacher expectations, etc. These are all legitimate determinants of the classroom situation. The decision of the teacher to implement one particular model of teaching is just one of these determinants. Because this study investigates the effects of the models of teaching instruments on teacher cognitions and teacher behavior, attention is focused on the pertinent theory elements. However, this does not mean that the other determinants of teacher behavior are considered less important. It just results from the fact that to answer the research questions, choices had to be made.

6.1.1.3 The theories selected

In section 6.1.1 it was explained that, as long as a number of criteria are met, the choice of a particular educational theory in this study is rather arbitrary. Accordingly, there is no special reason for the choice made in this research project, the Advance Organizer Model (Ausubel) and the Role Playing Model (Shaftel), apart from the fact that all participants considered these theories as widely applicable. The Advance Organizer Model concerns the transmittance of large amounts of coherent new information. It is assumed that it is the teacher's task to organize this information in such a way that it fits into the cognitive structure of the pupils. In most

cases this requires a previous re-activation of this existing cognitive structure. This can be achieved by presenting an "advance organizer", in most cases a statement that is basically familiar to the pupil and that is put on a higher level of abstractness than the lesson that follows it. The rest of the lesson also runs from general to specific. During the lesson all kinds of measures need to be taken to strengthen the cognitive structure of the pupils and to clarify the relationships between the concepts.
In their discussion of the Advance Organizer Model, Joyce & Weil (1980) of course report their sources. In this study we start from the Joyce & Weil "translation". Inevitably this leads to some constraints. No doubt other authors would have emphasized other parts of the theory or elaborated some parts of the theory differently. In any case this applies to the description of advance organizers. In this study advance organizers are mainly understood as superordinate knowledge. Basically, there are other kinds of prior knowledge that can facilitate the acquisition, organization and retrieval of knowledge. Relating new knowledge to existing parallel knowledge may likewise have the function of an advance organizer. In view of the research question of the present study, this sort of constraint is of little importance. The question at issue regards the possibility of developing a specific type of instrument. Which interpretation of the chosen educational theory is used or which details are subsequently stressed is of little importance to the research question. For the same reason no attention will be paid here to research on the effects of advance organizers (Luiten, Ames & Ackerson, 1980) or on the effects of various types of advance organizers (Lawton & Wanska, 1979). The controversy about the analogy between the advance organizer theory and the schema theory (Anderson, Spiro & Anderson, 1978; Ausubel, 1980) is also left out of consideration here.

The elaboration of the Role Playing Model is based on the pertinent chapter in Joyce & Weil (1980) and on Shaftel & Shaftel (1982). Role playing implies confronting the pupils with a dilemma, a problematic situation, in such a way they can identify with the persons from the situation. It is essential that they place themselves in the thoughts and feelings of the characters, and subsequently (in the role playing situation) act accordingly. Role playing permits the pupils to experiment in a "safe" environment with the consequences of actions and attitudes. This can lead to increased social skilfulness.
The remarks made in the discussion of the Advance Organizer Model about the choice of one particular elaboration of the theory and the stressing of particular details apply to the Role Playing Model as well.

6.1.2 Tracing essential elements in educational theories

It is clear that not all details of an educational theory can be translated into observable classroom behavior. To facilitate the development of the instruments, the educational theories were condensed into a number of essential "theory elements". Such a condensation inevitably leads to reduction of the theory. In the next chapters the concept "educational theory" (used within the framework of the treatment) has to be understood as the translation of this educational theory into these essential theory elements.

Joyce & Weil's models of teaching were the starting point for discerning essential theory elements. Studying the related original theories resulted in some modifications. After that, every theory element was examined to determine whether it was translatable into everyday classroom behavior and whether this translation could be done unambiguously.

In order to fit well into the video-instrument, each theory element had to be translatable into classroom behavior in such a way that the student-teacher with sufficient knowledge and skill would be able to recognize that and just that theory element in the pertinent lesson fragments. It turned out that a number of theory elements were not translatable into concrete classroom behavior or were translatable only in a rather ambiguous way. These were not incorporated into the video-instrument. In the end, this procedure resulted in 12 and 8 theory elements for the Advance Organizer Model and the Role Playing Model respectively.

For the Advance Organizer Model these theory elements are:

1 Clarifying the aim of the lesson.
2 Presenting the advance organizer (consisting of a statement at a higher level of abstractness than the learning materials and essentially already familiar to the learners).
3 Clarifying the elements and concepts from the advance organizer.
4 Presenting the new materials, starting with the general ideas and concepts, followed by the specifications (progressive differentiation).
5 Illustrating these differentiations with appropriate schemes.
6 Referring back to the advance organizer.
7 Referring back to the schemes (that illustrated the hierarchical relationships).
8 Giving and repeating precise definitions (by the teacher).
9 Asking the students to summarize the main points of parts of the lesson in their own words.
10 Indicating the similarities and differences between concepts or generalizations at a given level (integrative reconciliation).
11 Asking for additional examples of the concepts or generalizations from

the learning material.

12 Indicating the relativity of the learning materials by asking the students to recognize assumptions behind the material and to judge and challenge these assumptions.

For the Role Playing Model the theory elements are:

1 Providing the pupils with sufficient details about the problem situation, characters, etc.
2 Promoting identification of the pupils with the story characters.
3 Focusing the pupils on the problem or dilemma to be solved and preventing the pupils from devoting too much energy to details.
4 Pointing to and letting the pupils experience that there are many ways to define a problem, to solve it, to play a role, etc.
5 Concentrating on the thoughts and feelings of the players.
6 Concentrating on the possible personal and societal consequences of the actions and solutions chosen.
7 Comparing the role playing to real life (degree of realism).
8 Summarizing the comments or ideas of a number of pupils.

6.1.3 Characteristics of the treatment materials

The starting point in the construction of the treatment materials was that the lesson-episodes presented should be as realistic as possible and, consequently, be as familiar as possible to the student-teachers.
One of the first consequences was the involvement of complete classes instead of small groups of pupils. The classes (first year secondary education) did not receive any specific briefing beforehand.
The lessons, part of which are used in this treatment material, were given by student-teachers. The possibility of asking experienced teachers to give the lessons was discarded. Although experienced teachers might have done the job better, student-teachers were preferred because it was expected that for use at a teachers' college an instrument on which student-teachers were the "actors" would be more appealing.
In principle the instruments had to be suitable for both student-teachers in primary education and student-teachers in secondary education. For this reason no lessons were given on subjects specific to secondary education (e.g., foreign language lessons). The student-teachers received no further directions concerning their choice of subjects. In most cases the topics were chosen in consultation with the collaborating teacher in the secondary school.
An important requirement was that the materials should fit into the normal

curriculum for teacher education. The cooperating teacher educators insisted on this requirement. This meant that the total amount of time to be spent on a model of teaching had to be strictly limited. In the present conception, covering one model of teaching requires about four hours, apart from the student-teacher's independent study of the educational theory concerned. During these four hours no specific (e.g., organizational) measures have to be taken for working through the materials. The only demand is the permanent availability of video equipment to show the videotape. At this moment there are no teachers' colleges where this creates a problem.
During the try-outs it appeared that working through the video-materials is very labor-intensive. The student-teacher is constantly asked for reactions and comments. The alert attitude required is very fatiguing. For this reason in the explanatory note to the materials it is advised to spread working through the video-materials over at least two sessions. A very important characteristic of the video-materials is of course the effort made in them to bring about a learning effect. To that end the student-teachers constantly receive feedback about the right answers on the questions that were posed on them.
If the student-teacher has studied the related educational theory, it is in principle possible to work through the videotape independently. It is, however, advisable that a teacher educator is at hand to discuss possible obscurities.

6.1.4 Construction process

For the construction of the video-materials it was necessary to have available a great amount of "rough materials": lessons in which the theory elements were clearly seen. These lessons were given by 10 student-teachers (four women and six men) in secondary education, who were in their fourth year of teacher-training. These student-teachers had no specific experience concerning teaching "for videotaping". Five of them gave lessons using the Advance Organizer Model and five using the Role Playing Model.
During the whole construction phase there was a collaboration with the same teachers' college for secondary education; two teacher-educators from this college participated in the project. The lessons were given to complete classes in the first year of secondary education that consisted of 20 to 25 pupils. The classes were from two schools in Nijmegen that were regular probationary schools of the teachers' college. One school was of the type LBO/MAVO (lower secondary) and one of the type MAVO/HAVO/VWO (higher secondary). There were no special demands made upon these secondary schools. There is no reason for not considering the classes as "average" ones.

The technical aspects of recording and assembling were taken care of by the specialized personnel of the teachers' college.
The construction processes are analogous for the Advance Organizer Model and the Role Playing Model. Construction of the instrument for the Role Playing Model did not start before the construction of the instrument for the Advance Organizer Model was completed. The following steps can be discerned in the construction process:

1. Preparation of the lessons

Five student-teachers (for each theory) were asked to give a lesson in which the pertinent theory was "to been seen" as explicitly as possible. In fact it was a matter of giving a "model" lesson, in which the theory elements were illustrated so clearly that the lesson episodes could be used in the video-instrument. The student-teachers were thoroughly instructed in the theory, using, among other things, a 15 page text about the theory. In this text all theory elements were discussed and illustrated in a detailed way. It also goes into the application of the theory in concrete classroom behavior.

2. Giving the lessons

The student-teachers gave their lessons to three different classes (all of these in secondary school). Because there were three parallel versions of each lesson, it was possible to select the most unambiguous and clearest version of a particular lesson episode for inclusion in the final instrument.
In order to obtain the best technical quality, all lessons were recorded in a specially equipped classroom at the teachers' college. The lessons lasted 40 minutes on the average.
One camera was constantly recording the behavior of the teacher, while two cameras recorded pupil behavior. Two videotapes were produced simultaneously from each lesson; these were used in assembling the instrument. Because every student-teacher gave his or her lesson 3 times, for the final construction of the instrument there were 5 x 3 x 2 = 30 videotapes available (for each of the two models).

3. Selecting lesson episodes and assembling the instrument

Those lesson-episodes that were clear illustrations of the theory elements were selected for each of the final instruments. The lessons differed widely in the number of usable lesson-episodes. However, the number of usable lesson episodes turned out to be amply sufficient to

construct the instrument. Of course there were also differences in the number of times the various theory elements were available. These differences were mainly caused by the logical function of the theory elements. For example, "clarifying the aim of the lesson", one of the theory elements from the Advance Organizer Model, is normally done just one time during a lesson.
A detailed outline of the usable lesson-episodes was made for every lesson. Subsequently, decisions were made concerning the inclusion in the instrument, the number of seconds available, the spoken explanation to be added on the tape, the written information to be added on tape, etc.
The lesson episodes used from one lesson always remained in the original sequence: if lesson fragment B comes after lesson fragment A in the original, this is also the case in the instrument. If the function of a particular lesson episode in the totality of the lesson is unclear, there is a spoken explanation on videotape.
The final assembling of the tape was carried out according to very detailed scenario.

4. Try-out and revision

The instruments were tried out with about 220 student-teachers from teachers' colleges for both primary and secondary education. Both the teacher-educators and the researchers participated in the try-outs.
The instruments were revised on the basis of reliability and feasibility data. In the definite version particular questions were replaced, the time for reflection at particular questions was changed, there were changes in the way questions were posed, etc.

6.1.5 Format of the treatment materials

Before viewing the videotape the student-teachers studied the pertinent theory. Just before the start of the videotape they are, by means of a two-page explanatory note, informed about the structure of the videotape and about the procedure to be followed in working through the tape.
The videotape for the Advance Organizer Model is of 60 minutes' duration, the videotape for the Role Playing Model of 56 minutes' duration. Each videotape consists of a number of questions. These questions have the following structure. At first the question is posed, for example, "presently you will see a lesson episode from a lesson about environmental pollution. After viewing the episode, indicate which of the following three theory elements emerges there: (1) presenting the advance organizer, (2)

clarifying the aim of the lesson, (3) giving and repeating precise definitions". These three theory elements are both mentioned by the voice and visible on the screen. Subsequently, the pertinent lesson episode is shown. After that, the names of the three theory elements again appear on the screen. At the lower righthand corner of the screen appears the sign "XX". From the explanation about the tape the student-teachers know this is the moment to give an answer to the question posed. For that purpose every student-teacher has a form on which all question-screens from the videotape are printed. Here the student-teacher marks one of the theory elements. During the try-out it appeared that 10 to 15 seconds are in most cases sufficient to do that. Finally, the right answer is shown on the screen, in most cases accompanied by a spoken amplification.
The above reflects the basic structure of the questions. In the videotapes several variants are used, e.g., questions where the alternative answers are not given beforehand, but the student-teachers have to formulate the answer themselves. There are also requests for an argumentation or questions where a choice has to be made from two or three lesson episodes shown on tape. However, basically the question is always the same: to what degree does the student-teacher recognize the theory elements in real lesson-episodes.

The structure of the two tapes is analogous and shows a progressive degree of complexity; the questions are distributed over three parts. After the first and the second part, the student-teachers' attention is drawn to the possibility to discuss particular obscurities in class or read through some parts of the theory again.
In part one and two each question is concluded with the right answer on the screen. In the third part, this is postponed till the end. The structure of the Advance Organizer instrument is as follows:
Part 1: 18 questions,
Part 2: 10 questions,
Part 3: 18 questions.
For the Role Playing instrument these figures are:
Part 1: 13 questions,
Part 2: 7 questions,
Part 3: 14 questions.
The last 10 minutes of the Role Playing instrument are devoted to the sequence of the steps to be followed in giving a role playing lesson. This part was included because lesson-sequence is relatively important in the Role Playing Lessons; the teacher educators insisted on this part, mainly for didactic reasons. In this last part of this tape some lessons are run through chronologically. In the lower lefthand side of the screen there is a counter indicating the number of seconds that have passed by. The

student-teachers are asked to mark (1) at which counter-number a new "step" in the lesson-sequence starts, and (2) which step is at issue there. This part of the videotape of the Role Playing instrument is different from the rest of the videotapes. The performances of the student-teachers on this fourth part are not entered into the total score.

6.1.6 Reliability and validity

In this section the reliability and validity of the treatment materials are dealt with. The reliability and validity of the procedure for measuring teachers' interactive cognitions and teachers' behaviors will be treated in sections 7.1 and 7.2 respectively.
The decision to construct instruments of one hour's duration of course limited the number of questions that could, with the format chosen, be posed. This was especially problematic with the Role Playing instrument. The last part of this tape was used to demonstrate the sequence-steps of the Role Playing lesson, apart from the 8 theory elements (cf section 6.1.5). This meant that the total number of questions in the Role Playing instrument is substantially lower than the number of questions in the Advance Organizer instrument, which leads to a lower reliability.

Two teachers' colleges for secondary education and four teachers' colleges for primary education were asked to participate in the data-gathering. There were no relevant special criteria for selection of the teachers' colleges, so they were chosen on the basis of their geographical location or because there was an existing working-relationship between the researcher and one of the teacher educators of that teachers' college. All teachers' colleges agreed to cooperate upon first request.
The teacher educators were allowed to decide whether they would work through the Advance Organizer instrument, the Role Playing instrument or both. It appeared that relatively more teacher educators were interested in the Advance Organizer instrument. The videotape, short instructions for the teacher educator and the student-materials were sent to the participating teachers' colleges. Only student-teachers who had never seen the materials before were included in the sample. After completion, the teachers' colleges returned the filled-in student materials. Because each videotape was (as was intended) worked through over several lessons, a substantial number of students had not worked through the entire tape. This was the result of their absence during one (part) of the lessons. These student-teachers were excluded from the analysis. Only complete sets of data were included in the analysis. This decision resulted in sample sizes of 234 and 151 for the Advance Organizer Model and the Role Playing Model respectively, the total

sample size from the primary teachers' colleges being 189 and from the secondary teachers' college 196. The related reliabilities were .73 and .64 for the Advance Organizer Model and the Role Playing Model respectively. With the Spearman-Brown formula for increasing the test length it can be determined that the reliability for the Role Playing instrument would be .71 if the one hour time limit were dropped and the instrument (like the Advance Organizer instrument) contained 46 items.

The reliability of the treatment material is, in view of the function of the material and in view of additional characteristics of the materials, considered acceptable. These additional requirements pertain not only to the one hour time limit, but also to the following. During the construction of the instrument, in a number of cases items that hardly discriminated between individuals have purposely not been removed from the instrument. This has to do with the pursuit for content validity of the instrument with respect to the educational theory; if all essential theory elements from a particular educational theory must be seen on the videotape, this means that also relatively simple elements (i.e., elements that are easy to recognize for almost all students) have to be included. An even more important reason for not removing particular items that hardly discriminate among students has to do with the learning effect that is strived for with this instrument. As stated previously, the instrument's function is not only to evaluate student-teachers' knowledge of educational theory, but also to bring about a learning effect. This latter requirement implies that it may be didactically sound to let a majority of the students make a mistake that arises easily and to subsequently discuss that mistake in the explanatory remarks on the tape. The resulting low p-values of the items concerned have a negative influence on the reliability.

Determining the validity of these instruments in the classical sense is impossible because no similar instruments that measure the same ability exist. It is, therefore, impossible to determine validity by direct correlational evidence.

During the construction of the materials, an attempt was made to realize the kind of built-in validity that Ebel (1983) terms 'intrinsic rational validity'. In his article, he applies Flanagan's idea of using comprehensive rationales as a means of producing valid tests. By intrinsic rational validity, Ebel refers to explicit verbal definitions of what the test is intended to measure and to rational arguments in support of the means chosen for obtaining the measurements. In Ebel's view, this explicit rationale is the primary and most important basis for test validation.

The rationale for designing the kind of instrument chosen here, on the basis of the 'cognitive orientation', is given in Chapter 2. An explicit account of the decisions made during the construction process is given in

sections 6.1.1 to 6.1.4. The explicitness of both rationale and subsequent decisions are the basis for the claim that the final product is a valid operationalization of "the ability to recognize educational theory in real life classroom episodes". Both the significance of the measure and the grounds for choosing this particular operationalization were extensively accounted for and are in this way open to critique.

As to the content validity of the instruments with respect to the two educational theories chosen, there was a heavy reliance on Joyce & Weil's "translation" of the pertinent educational theories. After that, the decision to add or delete a particular theory element was based on its suitability to be represented in classroom behavior. Although the final instruments are seen as valid illustrations of the educational theories, the precise representation of every aspect of the original theory is relatively unimportant with respect to the main research questions. As already discussed in section 6.1.1.3, this investigation is about the possibility of developing a particular type of instrument and about its effects; the investigation is about teacher training didactics. Which interpretation of a particular chosen educational theory is used or which details of that theory are subsequently stressed is of little importance to that investigation.

6.1.7 Written texts on the educational theories

In the construction of the videomaterials it was supposed that the teachers who worked through these materials had studied the particular educational theories beforehand. There are of course existing texts about these two educational theories that could be used by the teachers to this purpose. However, it appeared that there was a need for a text that treated the theories in a concise way and that purposely went into the central elements of theories, the theory elements that are the focus of the videotapes. A 15 page text was written for each of the two educational theories, cf. Appendix I *). The final page of each text was in a different color and listed the numbered 12 and 8 theory elements of the Advance Organizer Model and the Role Playing Model respectively. The text treats the particular educational theory as far as it is relevant for application of that theory

*) The Appendices to this study have been compiled in a separate volume: Verloop, N. (1989). *Interactive cognitions of student-teachers. An intervention study. Appendices*. Interne Documentatie no. 316. Arnhem, The Netherlands: CITO, National Institute for Educational Measurement.

in the classroom; theoretical issues are treated only if they are functional for a more thoughtful application of the theory. Many examples are given in the text. The way in which the theory elements are revealed is analogous for the two texts: every reference to a theory element is indicated by an circled number in the left margin. This number corresponds to the number of that theory element on the final page of the text. In this way student-teachers are from the beginning focused on the central elements of the educational theory.
There are no prescriptions regarding the way in which the text should be studied. Because student-teachers rated the degree of difficulty of the texts as appropriate (cf. section 6.1.8) and for that reason the permanent availability of the teacher educator is not deemed necessary, studying the text at home is the most obvious. In any case, possible obscurities should be clarified before the videotape is started.

6.1.8 Feasibility of the materials

A group of student-teachers filled in a questionnaire after working through the materials under 'normal' conditions. This meant, among other things, that the groups of student-teachers involved were free to choose the amount of time to spend on the tape, especially if they did not want to work through the entire tape. This meant that the large sample of student-teachers that was used for gathering the reliability data could not be used to gather the feasibility data. Feasibility data were gathered with a separate sample of 120 student-teachers. Of these teachers, 79 had studied the Advance Organizer Model and 41 had studied the Role Playing Model. Within both groups the proportions from teachers' colleges for primary and for secondary education were the same. Data gathering took place by means of a questionnaire, completed immediately after working through the videotape. The questionnaire consisted of 20 questions and was analogous for the Advance Organizer Model and the Role Playing Model (cf. Appendix II).
Analogous to the findings in the try-outs, it appeared that teachers considered the videotapes rather long: on a rating scale ranging from "too long" (score 1) to "not long enough" (score 5), the average rating was 2.3 This means that, apart from the time constraints in the teacher training program, the one hour time limit must not be exceeded, despite the fact that this might be interesting with respect to the reliability. It appeared that the length was somewhat more problematic to the student-teachers from teachers' colleges for primary education than to those for secondary. Apparently, working on one educational theory in such an intense way has to be of a limited time duration.
Teachers' opinions about the written texts on educational theories were

generally favorable: 93% of those who read the texts considered them clear, they judged them slightly too long and of exactly the right degree of difficulty.

In the questionnaire there was a distinction between two possible goals of the videotape. Of the teachers, 70% said that the first goal of the instrument ('Determine whether you understand the theory so well that you are able to recognize theory elements in real-life classroom episodes') had been achieved, 24% said that it had been "partially" achieved, while 3% said that this goal was not achieved. For the second goal of the videotape ('To attain learning effects by viewing the videotape') these percentages were 60, 36 and 4 respectively.

When asked to make a comparison between the video-instrument and other evaluation-instruments, 68% of the total group of student-teachers preferred the video-instrument, 11% preferred written or oral questioning and 13% said they had no explicit preference. The Advance Organizer instrument led to a slightly more favorable judgment at these points than the Role Playing instrument.

The great majority of the teachers was of the opinion that the material can be worked through individually: 80% considered help of the teacher educator unnecessary, while 9% considered it necessary.

The final question was whether one would appreciate working with this type of instrument on additional educational theories in the future; 80% of the teachers answered positive, 8% negative, while 12% had no opinion. In this respect there were no differences between student-teachers who had worked through the Advance Organizer or through the Role Playing instrument. There were also hardly any differences between student-teachers from teachers' colleges from primary and from secondary education.

Even with a cautious interpretation of the data it can be concluded that the teachers' opinions about the video-instruments are generally favorable. It is true that working through the materials is seen as 'hard work', but on the other hand the materials are seen to achieve the goals for which they were developed. Compared to other evaluation-instruments, opinion about the video-instruments is positive; this also appears from the alleged appreciation for this sort of material in the future.

6.1.9 Possible uses of the materials

This material can be used in all situations in which a teacher educator wants to determine whether his of her student-teachers are able to recognize the pertinent educational theory in real-life classroom episodes. So the material is interesting only to those teacher educators who believe that educational theory is to some degree relevant to prospective teachers

and who believe that prospective teachers should be confronted with that theory in a systematic way. Moreover, the teacher educator has to be of the opinion that it makes sense, in any case during training and evaluation, to dissect the pertinent educational theory into a number of central theory elements. Finally, one has to attach great interest to evaluations which try to link theory and practice. For a purely theoretical (verbal) evaluation of educational theory there are more efficient ways than the instruments developed here.

The first pretension of the material goes no further than giving an opportunity for practice-oriented confrontation with and evaluation of the pertinent educational theory. From the point of view of the teacher educator, this phase could be seen as a step in an "ideal" sequence, starting from verbal presentation of theory. Joyce & Showers (1980) discern the following steps: presentation of theory, demonstration, practice, feedback, coaching. This sequence is ideally supposed to lead to changes in teacher behavior. In this cycle our material mainly focuses on theory and demonstration (cf. section 2.5). It is the teacher educator's decision what other steps he or she wants to include in the total cycle. In Chapter 2 a number of studies have been discussed from which it appears that protocol-like materials can also have direct effects on teacher behavior, a fact which is also pointed out by Joyce & Showers. This study focuses on the determination of the effects of the materials on teacher cognition and teacher interactive behavior. It is clear that, as far as that kind of effect will be revealed, teacher educators can also purposely choose the materials to achieve those effects.

In this investigation the material has been used in initial teacher training; there are no reasons to suppose that it cannot be used in inservice teacher training. However, there has been no inquiry into this question.

An important possible use of the material might be the student-teacher's individual working through the tapes. Especially when a teacher educator is available for help "on request" it must, also in view of the additional commentaries that are included in the tape, be possible for the individual student to work through the instrument. A availability of a number of videotapes has the advantage that the teacher can choose the theories that are most appealing to him or her at that moment, or that theory for which an application (at the probationary school) is in view. This relieves the teacher educator of some time-consuming instruction and evaluation tasks and sets time free for individual help and coaching.

The applicability of the two educational theories chosen here is of course related to the character of those theories and to one's evaluation of those theories. The Role Playing instrument is only relevant to those who explicitly try to improve social and communicative skills. In the inves-

tigation the Advance Organizer Model was used with geography, history, Dutch, physics, arithmetic and biology. These applications have little to do with the essence of the instrument that is at issue here. In section 6.1.1 it was already stated that the selection of these two educational theories was made rather arbitrary.
From the beginning an attempt was made to make the materials functional for teachers' colleges for both primary and secondary education. Also for that reason, all pupils on the tape are about 13 years of age. So far there are no reasons to believe that there are essential differences between the way in which student-teachers from primary education can use the material and the way student-teachers from secondary education can do that.

By way of conclusion of this section it is observed that ideally the treatment of this study would have been in the form of interactive video. Its capacity to react to the individual teacher's responses and to display in any order scenes for illustrating concepts from educational theories enables the teacher educator to provide for every student-teacher the optimal 'path' through the material, supplying permanent evaluation and feedback (LeBrasseur, 1986; Brown, Gliessman & Ochoa, 1987). Because during the development of the treatment materials this technique was not yet available for our kind of applications, it fell outside our scope of attention. It should, however, be seen as the logical next step in the development of this kind of materials.

6.2 Sample and design

Only the sample of the main study, in which the effects of the treatment-materials are determined, is discussed in this chapter. The sample used for obtaining reliability and feasibility data was described in section 6.1.6.
The sample for the effect study consisted of 30 student-teachers, in the third year of their training, 15 from the teachers' college for primary education and 15 from the teachers' college for secondary education.
Restricting the size of the sample was necessary because of the very labor-intensive investigation procedure that would follow. Because every lesson given by the student-teacher was given at his or her own probationary school and because stimulated recall and additional measures took several hours per lesson, initial data-gathering took one day per lesson. Coding stimulated recall data and the videotape of the related lesson took 3 to 4 days per lesson. Thus, about 60 weeks were needed for data gathering and coding of the data.
Indeed, it appears that all researchers in this field work with small samples. In their review article in the third edition of the Third Handbook

of Research on Teaching (Wittrock, 1986), Clark & Peterson discuss 12 studies in the field of teachers' interactive thoughts and decisions using stimulated recall. The average number of teachers in these studies was 11.4. (If the study by Morine & Vallance is excluded, this figure even drops to 9.7.)

In the present study the sample consisted of 17 men and 13 women. During the investigation no student-teacher dropped out of the sample. The student-teachers were from one teachers' college for primary education (in Sittard) and one teachers' college for secondary education (in Tilburg). The researcher already had working connections of a different kind with these teachers colleges. Neither the teacher educators nor the student-teachers knew the treatment materials beforehand or had participated in the construction. There are no reasons to believe that these teachers' colleges differed in any important respect from the other teachers' colleges in The Netherlands. With regard to the secondary teachers' college a choice had to be made concerning the specializations of the participating student-teachers. These student-teachers were chosen from those who in any case also specialized in social studies. It could not be verified whether this resulted in a representative sample of student-teachers for secondary education. It is clear that in this respect a choice had to be made. At first sight, this choice seems less problematic than choosing, for instance, a group of majors in mathematics or art.

None of the student-teachers had any specific experience with teaching that was recorded on video. Both at the teachers' college for primary education and at the teachers' college for secondary education, two classes of student-teachers were involved in the investigation. At each teachers college the students from the two classes were pooled and randomly assigned to 3 conditions:

Group 1 the TT (Theory & Tape) -group. These student-teachers were instructed in two educational theories (the Advance Organizer Model and the Role Playing Model), including the two texts, and worked through the video materials.

Group 2 the T (Theory) -group. These student-teachers were instructed in the two educational theories, including the two texts. They spent the same amount of time on the two theories as group 1.

Group 3 the C (Control) -group. These student-teachers formed the no-treatment group and followed the normal program in educational theory.

After the treatment, 5 student-teachers were randomly selected from each of the 3 conditions. This was done both at the primary and at the secondary teachers' college. In that way 10 student-teachers from each of the 3 conditions were actually included in the experiment.

In section 6.3.5 an overview of the total procedure will be presented, including the additional measures taken.
To prevent all previous influencing of student-teachers' cognitions, there were no pre-treatment measures in the design chosen. All measures were taken after the stimulated recall had taken place.

The design chosen is discussed in the literature under the name of "Randomized control-group posttest only design" or "Simple randomized subjects design" (Kerlinger, 1976). It can be depicted as follows:

R	X_1	O
R	X_2	O
R		O

The main weakness of this design is that it does not permit tests of equality of groups, as do pretest-posttest designs. There is the possibility that the randomization might not have resulted in completely equivalent groups. However, the variables under study are of such a nature that pre-treatment measurement was considered too precarious; it might have easily led to interactions with the experimental treatment. The design chosen is generally considered appropriate in that circumstances. Besides this design controls for, although it does not measure, all classical threats to internal validity, such as history, maturation, etc.
There are no indications that the members of the three conditions exchanged information about the treatments. After stimulated recall this question was explicitly asked. However, even if this had been the case, it could have influenced the results only in a conservative way: mutual exchange of information can only have diminished the differences between the results of the three conditions.

As to the external validity of the design, it is assumed that the student-teachers from these teachers' colleges do not differ from those of the Dutch teachers' colleges in general on variables that are relevant for this study and can be considered a random 'sample' from the teachers' colleges in The Netherlands.
Testing this latter assumption was not part of the investigation. To the degree that there may be doubts about this assumption, the external validity of this study may be challenged.

6.3 Procedure

It is important to notice that the procedure described in this section was completely analogous for the two educational theories. So each step described in this section was executed twice for every student-teacher, once for the Advance Organizer and once for the Role Playing Model. An exception to this rule are the instruments described in section 6.3.4.2. These instruments do not pertain to a specific lesson or theory, so they were administered only once.

6.3.1 Procedure at the teachers' college

The two educational theories were taught at the teachers' college by the student-teachers' own teacher educators. For each theory the student-teachers studied the written text of about 15 pages (see section 6.1.7) at home. At the teachers' college the theory was further explained and discussed. The TT- (Theory & Tape) students subsequently worked through the video materials, answering the questions on their sheets and discussing theory elements that were unclear. The T-students (Theory) got many types of assignments related to the theory (e.g., "If you were to give a lesson about subject X to a group of 14-year old pupils with no specific knowledge of the subject, what kind of advance organizer would be appropriate?") and continued discussing the theory. Care was taken that the two groups spent the same total amount of time working on the theories. The C-students (Control-group) got no special treatment and continued with the normal educational theory program.

In order to ensure that the treatments at the two teachers' colleges (primary teachers' college and secondary teachers' college) were parallel, a strict scenario was agreed upon concerning the time to be devoted to discussing the videotape, the written texts, etc.

Preceding the whole procedure the student-teachers were told that the teachers' college was participating in a research project and this could imply giving some lessons by the student-teachers. Given the specificity of the research questions, it did not seem advisable to explicate the focus of the research to the student-teachers. The students were told that the goal of the research was making a description of their teaching behavior, one of the focusses being the difference between teaching behavior of student-teachers for primary education and student-teachers for secondary education. There were no signs that this explanation was unsatisfactory to the student-teachers.

The teacher educators did not notice any preference of the student-teachers for one of the experimental conditions.

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6.3.2 Procedure at the probationary school

About one month after instruction in the two educational theories, the students were asked to give two lessons at their own probationary schools. Students from group 1 (TT-group) en 2 (T-group) were asked to give two lessons, a lecture lesson and a role playing lesson, in which they used the knowledge about lecture lessons and role playing lessons they had acquired one month before. Students from group 3 (C-group) were asked to give a lecture lesson and a role playing lesson. No specific assignments were given concerning choice of subject. Restriction to one subject would, in the opinion of the researcher, have produced the danger of finding artifacts in the stimulated recall data: effects that are caused only by the choice of that specific subject. It can be expected that if a lesson about a specific topic is to be given, student-teachers will probably get their information, at least in part, from the same sources, which can have consequences for the content and structuring of the lesson (and the related thought processes).
In any case, it would have partly restricted the 'natural' diversity in content found in lessons on a particular school subject, thereby reducing the external validity of the findings (cf. Colker, 1984). It was hoped that the magnitude of this diversity would not introduce too much error variance into the difference between the experimental groups. In the preparation of the lesson the student-teachers were free to use any materials they found appropriate. There were no instructions concerning the amount of time to be spent on lesson planning. A written lesson plan was made for each lesson. The student-teachers made all the arrangements with the probationary schools themselves. They were told that the lessons would be recorded on video and that after the lesson there would be an extensive discussion of the lesson. They were asked to arrange for a quiet room at the probationary school in which this "discussion" could take place without disturbance.
The student-teachers for primary education gave their lessons to complete classes of the 8th grade of primary education (pupils of about 12 years old), the student-teachers for secondary education to complete classes in the 1st year of secondary education (pupils of about 13 years old). The pupils were not informed beforehand about the topic to be treated or the fact that video recording would take place. The lessons lasted about 40 minutes. Recording took place with one camera from the back corner of the classroom. The camera continuously focused on the teacher, except during the actual role playing scenes, when it focused on the participating groups of pupils.
In a pilot study it appeared that it was not only difficult to focus the camera on those pupils to which the attention of the teacher was directed at a particular moment, but it turned out that the focus of the camera

influenced the content of interactive thoughts the teachers reported during stimulated recall. So, it was decided that in the main study the camera would continually focus on the teacher.
Because every student-teacher had to be visited at his or her own probationary school, it was not possible to investigate more than one lesson per day. On the average there was a two week interval between the two lessons. Half of the student-teachers started with the lecture lessons and half with the role playing lessons in order to control for "learning" effects concerning proficiency in stimulated recall.

6.3.3 Stimulated recall

After giving the lesson, the student-teachers took a short break. Stimulated recall always started within half an hour after termination of the lesson. In a pilot study a procedure was experimented with which was discarded in the main study. It allowed the student-teachers to see the entire videotape beforehand, in order to get them accustomed to seeing themselves on videotape. It appeared, however, that student-teachers who had seen their lessons beforehand were, compared to student-teachers who had not seen the tape, inclined to express during stimulated recall rationalizations at those parts of the lessons where "things went wrong". Probably with student-teachers, this tendency is even stronger than with experienced teachers. Student-teachers are accustomed to having their lessons evaluated by others, and probably are inclined to look at their own lessons "through the eyes" of an outsider. Having already seen the lesson one time in such a way may influence subsequent stimulated recall. It was decided not to follow this procedure in the main investigation. It also led to emphasizing the non-evaluative stance of this investigation more explicitly during the instructions for the stimulated recall, thereby assuring them that no information about either the lesson or the stimulated recall data would be reported to the teachers' college.

In Chapter 4 it was discussed why it is advisable not to make the instructions for the stimulated recall too specific. The literal instructions in this study were as follows:

> We will now look at the lesson you just gave. The purpose of our viewing the lesson is that you should try to remember what went "through your head" while you were teaching. Of course, during a 40 minute lesson there are lots of things that go "through your head". Without aid it would be impossible to remember. Our hope is that viewing the videotape of your lesson will help you to remember more of what you thought during

your lesson. When looking at the videotape try to "relive", to experience again, what happened during the lesson. Stop the videotape at every moment you remember something that went "through your head". Try to say anything you remember about it, without wondering whether this is important enough to say, or something like that.

However, what you say should bear upon the things you thought during the lesson. It should not concern things that you contrive now, while looking at the videotape, or things that strike you right now. Please stop the videotape [indicate how] every time you remember something that went through your head while teaching. Start the tape again [indicate how] when you have said what you wanted to say.

Sometimes student-teachers get so absorbed in looking at their own lesson that they seem to have forgotten the instructions. If that is the case (and you let the tape run for more than 45 seconds without saying something) I will stop the tape and ask you what you thought at that moment of the lesson. If you cannot remember what you thought at that moment, you can say that and start the tape again. But, in general, I will not interfere. You are the only one giving the information. I just listen and write something occasionally. Perhaps I will ask some short questions.

As you will understand right now, it is absolutely unimportant whether this was a good lesson or not, whether there was a fine atmosphere or not, etc. For this investigation, which is concerned with what went through your head while teaching, this is completely out of order. I am not interested in any kind of evaluation of this lesson. Anything you say will be dealt with confidentially. Neither your cooperating teacher at this school nor your teacher trainer will be informed about it. Any questions? You can start the tape.

From the instructions it appears that the only situation in which the investigator is allowed to stop the videotape is when the student-teacher waits too long a time before reporting about his or her thought process. The tape is never stopped by the investigator at particular or potentially interesting lesson episodes. The types of questions the investigator is allowed to ask are restricted to four types:

1 Literal repetitions or paraphrasings of the opening question ("What did you think?"). This question is asked when the investigator stops the tape because the student-teacher lets too much time pass before reporting.

2 Inquiries about whether the teacher utterance is interactive or not ("Is this something you thought during the lesson or did you notice this right now?"). This question is asked in all cases where the investigator is uncertain about the character of the teacher utterance, the infor-

mation the student-teacher gives being insufficient to decide whether the utterance is interactive or not.

3 Paraphrasings of the teacher-utterance, to stimulate the teacher to give more information about this topic.

4 Short encouragements, like "I understand", "Okay".

The stimulated recall interview was audiotaped. During the stimulated recall every 60 seconds (plus or minus 20 seconds) the investigator literally recorded one teacher utterance. These utterances were written on separate cards and were used in some of the additional measures (cf. section 6.3.4).

6.3.4 Additional measures

This section describes the procedure followed to obtain the additional measures after the stimulated recall. The way in which these data were used to answer the research questions is reported in the pertinent sections, 7.3 to 7.5.

6.3.4.1 Measures taken directly after stimulated recall

After the stimulated recall there was a 15 minute pause. Subsequently, the following measures were taken:

a. Q-sort on interactive thoughts

One of the procedures for investigating the relationship between interactive thoughts and teacher behavior consisted of direct interrogation of the student-teacher about the function of a number of thoughts in their teaching behavior. The literally recorded teacher-utterances at one-minute-intervals (cf. section 6.3.3) were first looked through with the student-teachers. The ones that were not recognized as being their interactive thoughts were put aside. The remaining pile of cards was randomly reduced to 30. The student-teachers were given these piles of cards and got the following instruction.

> On these cards there are apparently a number of thoughts that "went through your head" while teaching. Thoughts that go through your head can have an influence on your teaching behavior. Some of these thoughts are of such a kind that their influence will likely be very small: if

during teaching you notice that it has started to rain outside (and you "think of" that fact for a moment), this will probably have no influence at all on your teaching behavior. On the other hand there can be thoughts that have an important and profound influence on your subsequent teaching behavior. What I should like to know now is the following: Here I have a collection of 30 thoughts that went through your head while you were giving that lesson. I should like to know how important each of these thoughts was, and by 'important' I mean: did this thought influence your teaching behavior? First of all read again all the thoughts and realize how important or unimportant that thought was. After that put the 30 cards in 5 piles of 6 cards each. At the extreme left pile the cards that you consider the most important and at the extreme right pile the cards that you consider the least important. In the piles from left to right the importance must gradually decrease.

Further details of this investigation procedure are reported in section 7.3.4.

b. Questionnaire

Twenty-eight questions were asked about the lesson-preparation, the lesson and the stimulated recall session, cf. Appendix VII *). The questions about the lesson preparation and about the lesson focused on the differences between the lesson just given and the normal lessons given at the probationary school up to now (concerning, for example, preparation time, pupil attention, etc.). The student-teachers were asked to what degree each of the theory elements was, in their own opinion, "to be seen" in the lesson just given. The questions about the stimulated recall-session mainly focused on the student-teacher's opinion about this procedure and about his or her ability to report their thoughts during stimulated recall.

c. Second Q-sort

In order to investigate the stability of the Q-sort on interactive thoughts (just discussed), this procedure was literally repeated.

*) See footnote on page 84.

6.3.4.2 General additional measures

About two months after the stimulated recall two more additional measures were taken. The student-teachers completed these two questionnaires at home.

a. Appraisal of educational theory

One of the main research questions pertained to the influence of student-teachers' appraisal of educational theory on their use (both behavioral and cognitive) of the two educational theories. So, it was necessary to describe the student-teachers' appraisal of educational theory in general. The investigation procedure was analogous for the two teachers' colleges:
With the help of the teacher educators the total educational theory program was divided into 21 parts. Twelve student-teachers who had not participated in the investigation were confronted with triads from these 21 topics and were at each triad asked in what respect these topics were alike or different. This Kelly-Grid-like procedure led to the elicitation of 15 constructs for describing the topics.
The 30 student-teachers from the main research were asked to rate each of the 21 topics ("elements") on each of the 15 constructs on a 7-point-scale. In order to examine the generalizability of the findings, the procedure was repeated with 30 students from two other teachers' colleges. The same constructs were used here. Further details of this part of the investigation are presented in section 7.4.

b. Student-teachers' implicit theories

Heikkinen (1978) developed an instrument for measuring teachers' educational philosophies as related to the four "families" of Joyce & Weil's models of teaching: information processing, social, personal and behavioral.
The instrument consisted of 28 statements, four sets of 7 statements each reflecting the philosophy of one of the four "families". To determine whether the translated instrument could also be used with the student-teachers in this study and to determine whether relationships between these data and the experimental results could be found, each of the 28 statements was printed on a separate card and the student-teachers were asked to arrange the cards, following a specific procedure, on the basis of the criterion "agree/disagree". Details of this part of the investigation are reported in section 7.5.3.

6.3.5 Overview of the procedure

TT (Theory & Tape-group)	Study educational theory	Work through video instrument	Give lessons at probationary school	Stimulated recall and direct additional measures	General additional measures
T (Theory-group)	Study educational theory	Discuss educational theory in class	Give lessons at probationary school	Stimulated recall and direct additional measures	General additional measures
C (Control-group)			Give lessons at probationary school	Stimulated recall and direct additional measures	General additional measures
Covered in section	6.3.1	6.3.1	6.3.2	6.3.3 and 6.3.4.1	6.3.4.2

6.4 Specification of research questions

In Chapter 5 the research questions were discussed at a general level. Now that the design and the procedure of the investigation have been presented, the research questions can be listed more specifically.

In Chapter 5 the main research questions were defined as follows:

a Does the experimental treatment have any influence on the use of educational theory in subsequent interactive thinking?

b Does the experimental treatment have any influence on the use of educational theory in subsequent interactive teaching behavior?

c If there is any influence of the experimental treatment on teachers' interactive thinking and on interactive teaching behavior, how are these cognitions and actions related?

d What is the relative influence of teachers' appraisal of educational theory (taught during teacher training) on their use of educational theory in cognitions and actions, compared to the influence of the experimental treatment?

Besides, a number of additional topics were brought together under one point:

e The predictability of teachers' interactive thoughts and interactive behavior from their scores on the video-instrument.
The influence of the experimental treatment on teachers' lesson planning.

The relationship between teachers' educational philosophies and their use of educational theories in their cognitions and actions.
Teachers' opinions about their own lessons and about the investigation procedure.

For a general discussion of these research questions the reader is referred to Chapter 5. The specifications of the questions are presented here:

ad a. Influence of treatment on teacher cognitions

Stimulated recall was used to examine to what degree educational theories play a role in teachers' interactive thoughts. Given an acceptable reliability of coding these data into interactive versus non-interactive and into theory versus non-theory (see section 7.1.3), the central questions concerning the stimulated recall can be posed. These questions are directed to the heart of the investigation; question a.1. can even be considered the most important question of this study.

a.1. Are there any differences between the experimental groups concerning the number of theory elements in their interactive thinking, specified for each of the theory elements?

a.2. Are there any differences between the experimental groups concerning the proportion of the (12 or 8) theory elements that occur at least once during the teachers' interactive thinking?

Apart from the existence of three different experimental groups, the following questions are also relevant:

a.3. Are there any interaction effects between treatment and type of educational theory (Advance Organizer versus Role Playing) concerning the number of theory-related thoughts?

a.4. Are there any differences in the number of theory-related interactive thoughts between student-teachers from primary teachers' colleges and student-teachers from secondary teachers' colleges?

a.5. Are there, concerning the number of interactive thoughts, any sequence-effects, i.e., effects caused by the lesson investigated being the first one versus the second one?

a.6. Are there any relationships between the number of teachers' theory-

related interactive thoughts and the size of the class?

It can be argued that the proper "use" of the educational theories by the teacher implies a well-balanced assimilation of the theory elements into the interactive thoughts. This means that dominance of one or two theory elements is undesirable, which leads to the following research question:

a.7. Are there any differences between the experimental groups concerning the average number of "dominant" theory-related interactive thoughts?

The variables just discussed relate to teachers' thoughts while teaching. The very use of stimulated recall has the function of eliciting especially interactive thoughts. (For a more extensive discussion see Chapter 4.)

ad b. Influence of treatment on teacher behavior

During a number of try-outs a detailed prescription-system was developed for coding the videotapes. The purpose of this system was to give directions for ascertaining which teacher behavior could be considered "in accordance with" the relevant educational theory. A description of the ways in which each theory element can be recognized in concrete classroom behavior was given.
Given an acceptable reliability of this instrument (see section 7.2.2) follow the questions related to the effect of the treatment on interactive teaching behavior:

b.1. Are there any differences between the experimental groups concerning the number of theory elements in the teaching behavior, specified for each theory element?

b.2. Are there any differences between the experimental groups concerning the proportion of the (12 or 8) theory elements that occur at least once during the teachers' teaching behavior?

Apart from the existence of three different experimental groups, the following questions are also relevant:

b.3. Are there any interaction-effects between treatment and type of educational theory (Advance Organizer versus Role Playing) concerning the number of theory-related thoughts?

b.4. Are there any differences in the number of theory-related behaviors

between student-teachers from primary teachers' colleges and student-teachers from secondary teachers' colleges?

b.5. Are there, concerning the number of theory-related teaching behaviors, any sequence-effects, i.e., effects caused by the lesson investigated being the first one versus the second one?

b.6. Are there any relationships between number of teachers' theory-related behaviors and size of the class?

ad c. Relationship between behavior and cognition

The relationship between behavior and cognition can be investigated with several degrees of "directness". In this study four measures of the relationship were taken. The first two are of a very indirect and rather superficial character. The first measure consists of determining the correlations between the data from the stimulated recall and the data from the videotape of teacher behavior.

c.1. Are there any differences between the experimental groups concerning the correlations between the stimulated recall-data and the teacher behavior-data, specified for the (12 or 8) theory elements?

During the interview following the stimulated recall the teachers were asked to rate, for each theory element, the degree to which that element was, in their opinion, "to be seen" in the lesson just given. An indication of their ability to make correct estimations of their own use of educational theory is given by the correlation between their own ratings and the actual use of educational theory observed.

c.2. Are there any differences between the experimental groups concerning the correlations between teachers' estimations of their own use of educational theory and the actual use of that theory observed, specified for the (12 or 8) theory elements?

The teachers were questioned about the relative importance of theory-related interactive thoughts, compared to non-theory-related interactive thoughts, for their teaching behavior. "Importance" was defined as "influencing teaching behavior". They were presented a sample of 30 cards with their own interactive thoughts and were asked to Q-sort these cards on the basis of "importance". The hypothesis was that the T & T-group would rate the theory-related thoughts as relatively more important.

A prerequisite for obtaining valid information is the randomness of the selection of the cards:

c.3. Is the proportion of the theory-related interactive thoughts in the 30 cards presented to the teachers the same as the proportion of theory-related interactive thoughts in all thought-utterances?

This being the case, the next question is:

c.4. Is the relative importance attached to theory-related interactive thoughts the same for the three experimental groups?

To investigate the stability of teachers' judgment, this measure was taken twice:

c.5. What is the stability of the data obtained for question c.4.?

The most direct comparison between behavior and thought was a detailed investigation in which for every theory-related teacher behavior (as exposed on videotape) the accompanying interactive thought (as exposed on the audiotape recorded during stimulated recall) was registered. "Accompanying" meant that the teacher had reported about a thought within a given time interval around the actual manifestation of a theory-related behavior. Several intervals were used. It was hypothesized that for the T & T-group relatively more theory-related teacher behaviors would be accompanied by "appropriate" (i.e., relating to the same theory element) interactive thoughts.

c.6. Are there any differences between the experimental groups concerning the proportion of theory-related interactive behaviors accompanied by "appropriate" interactive thoughts?

c.7. How do the results obtained for answering question c.6 vary if the interval on both sides of the teaching behavior is set at 20, 30 or 60 seconds?

ad d. Teachers' appraisal of educational theory

As explained in section 6.3.4.2, the teachers rated the 21 elements of educational theory they received during teacher training on 15 criteria ("constructs"). The first question refers to possible differences between teachers' colleges in this respect:

d.1. Are there, regarding the teachers' opinions about the educational theory program (as rated on the 15 constructs), differences between the teachers' colleges?

An attempt was made to depict the 15 constructs and the 21 elements in one dimensional space, thereby displaying the interrelations. Thus, the following questions are:

d.2. What is the structure of the teachers' opinions about the educational theory program?

d.3. Are there in this respect (d.2.) differences between the teachers' colleges?

If appraisal of educational theory is seen as an alternative hypothesis for explaining possible differences on the dependent variables (besides the explanation on the basis of a difference in experimental treatment), the following questions arise:

d.4. What is the relative importance of teachers' appraisal of educational theory on teachers' stimulated recall-scores (use of educational theory in interactive thinking), compared to the influence of the experimental treatment?

d.5. What is the relative importance of teachers' appraisal of educational theory on teachers' teaching behavior scores (use of educational theory in interactive teaching behavior), compared to the influence of the experimental treatment?

ad e. Additional research questions

Under this heading a number of less important research questions are grouped together. The function of most of these research questions is self-evident.

e.1. Are teachers' stimulated recall scores (use of educational theory in interactive thinking) or teachers' teaching behavior scores (use of educational theory in interactive teaching behavior) predictable from their scores on the original video-instrument?

If this is the case, the (easily obtainable) scores on the video-instrument would have a meaning far beyond the purpose for which this instrument was

constructed. Answering this question is, however, severely hampered by the small size of the sample.

e.2. Are there in this respect (e.1.) differences between the Advance Organizer instrument and the Role Playing instrument?

Lesson planning was not investigated in depth. For each lesson, a written lesson plan was produced by the teacher. It was determined to what degree theory elements were found in it.

e.3. Are there any differences between the experimental groups concerning the degree to which theory elements can be found in their written lesson plans?

Teachers' educational philosophies were measured with a translated version of an instrument consisting of 28 statements, grouped into 4 clusters of 7 statements. Each cluster reflected the ideas of one of the four "families" of Joyce & Weil's (1980) models of teaching.

A prerequisite for interpreting the data from this instrument is that in the structure of the data obtained with this instrument the four 'families' of teaching models can be discerned.

e.4. Are the 'families' of teaching models discernable in the data obtained with the instrument for measuring teachers' educational philosophies?

This being the case, it can be hypothesized that preference for one of the four families has consequences for using either the Advance Organizer Model or the Role Playing Model in one's own teaching. I.e., those who highly agree with statements considered representative of the 'social' family are inclined to apply the Role Playing Model relatively better and those who favor the statements considered representative of the 'information processing' family are inclined to apply the Advance Organizer Model relatively better.

e.5. Is there a relationship between preference for a particular educational philosophy and the 'use' (in cognition, behavior or both) of one of the two educational theories?

The final questions pertain to the teachers' reports about the lessons they gave and about the investigation procedure.

e.6. On the basis of the information given by the teachers, can the lessons investigated be considered 'average' lessons?

e.7. Are there in this respect (e.6.) any differences between the experimental groups?

e.8. What are the teachers' opinions about the investigation procedure?

e.9. Are there in this respect (e.8.) any differences between the experimental groups?

The analyses of the data gathered to answer the research questions and the results of these analyses for each question are reported in a separate chapter. Sections 7.1, 7.2, 7.3, 7.4 and 7.5 are parallel to the headings a, b, c, d, and e respectively.

7. INSTRUMENTATION, ANALYSES AND RESULTS

7.1 Teacher thinking

7.1.1 Introduction

Of the chapters that report the results of the investigation, the present chapter is the most important one. In the theory chapters (especially in Chapter 2) it was extensively discussed that within the cognitive orientation in teacher training, an attempt was made to improve teachers' interpretative abilities. The most important manifestation of this improvement concerns the change in teachers' cognitions during teaching. It was indicated that stimulated recall was considered an appropriate research technique for revealing these interactive cognitions. The research into the effects of the treatment on teachers' cognitions reported here pertains to data on interactive cognitions gathered with stimulated recall.

7.1.2 Method of investigation

A detailed description of the procedure that was followed during the stimulated recall sessions can be found in section 6.3.3. The literal instructions that were given to the teachers before the stimulated recall was started can also be found there. The data that were gathered about the stimulated recall procedure can be classified into two groups. In the first place, there are considerable quantitative data about the amount of time spent on stimulated recall, the number of teacher utterances that were recorded, etc. Secondly, the participants answered a number of questions that were posed immediately after the stimulated recall session. These questions relate to whether the three experimental groups differed in the way they experienced the stimulated recall procedure.

7.1.2.1 Quantitative data concerning the investigation procedure

a. Amount of time

The stimulated recall interview always started within half an hour after termination of the lesson. After 45 minutes the teacher was asked whether a short break was needed (10 to 15 minutes), after which the stimulated recall was continued. The total amount of time that was spent on stimulated recall was on the average 65.3 and 66.5 minutes for the Advance Organizer

Model and the Role Playing Model respectively. There were no significant differences between the three experimental groups in this respect. It should be noted that stimulated recall consisted of externalizing one's thoughts while viewing the videotape of one's own lesson. The time needed for viewing the tape of one's own lesson is included in the numbers just presented about the total amount of time. As already explained, the teacher continually stopped the tape and reported about the cognitions at that part of the lesson. Given the fact that the Advance Organizer lesson lasted 44.2 minutes on the average and the Role Playing lesson 45.8 minutes, it can be determined that the time spent on the sheer externalization of one's thoughts while teaching was on the average 21.2 minutes and 20.7 minutes for the Advance Organizer lesson and the Role Playing lesson respectively. Also in this respect there were no significant differences between the three experimental groups.

The total amount of time that was spent on stimulated recall is less than the figures that are reported from, for example, a number of related Canadian investigations on interactive teacher cognitions (Marland, 1977; Conners, 1978a; Cooper, 1979; Tuckwell, 1980a). For the interpretation of this fact, it is important to notice that during the stimulated recall session the investigator tried to interfere as little as possible. Chapter 4 includes a discussion of the threats to validity that are present if the investigator tries to control the stimulated recall process. For this reason it was decided not to give direct indications like 'Give special attention to the decisions that you make', 'Did something go wrong during the lesson?', etc. Besides, in this investigation the researcher was not allowed to stop the videotape himself at lesson episodes that could yield potentially useful information. The risk was considered too high that the teacher would in that way notice what kind of information was regarded as valuable by the investigator, and would subsequently report his or her thoughts accordingly. Everything was left to the teacher. It should be clear that this extreme reticence on the part of the investigator had the effect of shortening the total length of the stimulated recall interview. In some of the investigations that were reported in the literature, teacher and investigator even get involved in discussions about the teacher's interactive thoughts, thereby extending the total amount of stimulated recall time enormously.

b. Number of teacher utterances

More interesting than the amount of time the teacher spent on teacher utterances during stimulated recall is the total number of teacher utterances during each stimulated recall interview. It is clear that the 'total amount of time spent on teacher utterances' is influenced by the teacher's ten-

dency to report his or her thoughts in either a concise or a detailed way. Although this is important information, the crucial question of course pertains to the degree to which the educational theory is present in teachers' cognitions. Of course not only the number of reported instances but especially the character of the reported theory-related cognitions is important here. The next sections will report about the 'character' of the theory-related cognitions. This section will go into the number of utterances and some additional aspects.

The average number of teacher utterances during stimulated recall was 112.8 and 116.5 for the Advance Organizer lesson and the Role Playing lesson respectively. There were no significant differences between the three experimental groups. On the basis of the total amount of time spent on teacher utterances (21.2 minutes for the Advance Organizer lesson and 20.7 minutes for the Role Playing lesson) it was determined that the average single teacher utterance takes 11.3 seconds for the Advance Organizer lesson and 10.7 seconds for the Role Playing lesson. On the basis of these data it can be inferred that in the type of stimulated recall interview done here, i.e., the interview in which the researcher is very reticent and tries to interfere as little as possible, the teachers report about their cognitions in rather short statements, about 11 seconds on the average.

c. Type of teacher utterances

The term 'type of teacher utterances' refers to a distinction that is very important in this kind of investigation: the distinction between teacher utterances about interactive thoughts and teacher utterances about thoughts the teachers have construed afterwards (mainly during the viewing of the videotape of their lessons). This distinction will be referred to as 'interactive' versus 'non-interactive' thoughts. It is clear that in the stimulated recall investigation only the interactive thoughts are relevant. In the introduction to the stimulated recall session the teacher was told not to report "things that you contrive now, while looking at the videotape, or things that strike you right now". If during the stimulated recall interview the teacher states his or her utterance in such a way that the investigator is in doubt about the interactive status of a teacher utterance, he can, in order to obtain clarity, use one of the four permitted ways to interrupt: "Is this something you thought during the lesson or did you notice this right now?" This is, for instance, the case if the teacher uses a phrasing like "and now hurry up to the second lesson topic", not indicating whether that was a thought during teaching or a remark during stimulated recall. It is assumed that if the teacher reports that this thought was an interactive one, this is the case; (for a theoretical discussion of this problem, see Chapter 4). If during the analysis of the

audiotape of the stimulated recall interview, there appears to be lack of clarity about the interactive status of the teacher utterance, a set of decision rules is applied that is of a conservative nature, i.e., in case of doubt the teacher utterance is considered non-interactive; cf. section 7.1.3.

In a study like the present one, in which the effects of the treatment on teachers' interactive thoughts are investigated, the non-interactive thoughts should of course be left out of the analysis. The stimulated recall procedure can be called successful only if the percentage of the non-interactive teacher utterances during stimulated recall is relatively low. It appeared that the average number of non-interactive teacher utterances during the stimulated recall interview was 4.1 for both the Advance Organizer lesson and the Role Playing lesson. There were no significant differences between the three experimental groups. In view of the fact that the total number of teacher utterances is on the average 112.8 for the Advance Organizer lesson and 116.5 for the Role Playing lesson, it follows that of all teacher utterances the percentage of non-interactive ones is 3.6 and 3.5 for the Advance Organizer lesson and the Role Playing lesson respectively. It can be concluded that only a very small part of the total number of teacher utterances was of a non-interactive character and that, in this respect, the stimulated recall procedure has fulfilled its purpose.

d. Interruptions

The final part of the quantitative information about the stimulated recall procedure concerns the interruptions made by the researcher during stimulated recall. As stated in section 6.3.3, four kinds of interruptions were allowed during stimulated recall:

(1) Paraphrasings of the opening question "What did you think?"
(2) Inquiries about whether the teacher utterance is interactive or not.
(3) Paraphrasings of a given teacher utterance, and
(4) Short content-neutral encouragements.

As already said, the investigator tried to be as unobtrusive as possible during the whole session and to restrict the number of interruptions to the minimum, even though it was impossible for the teacher to derive specific indications from the allowed types of interruptions. The average number of interruptions turned out to be 5.6 and 4.6 for the Advance Organizer lesson and the Role Playing lesson respectively, with no significant differences between the three experimental groups. In view of the fact that during the stimulated recall interviews the investigator interrupted (almost always very short) only five times on the average, thereby adhering to the strict

rules for 'allowed interruptions', it can be concluded that in this respect there has been no influence from the part of the investigator.

7.1.2.2 Teachers' opinions

Directly after the stimulated recall session the teachers were interrogated about, among other things, the way they had experienced this procedure. Their opinions about this procedure could be termed 'favorable', with no significant differences between the experimental groups in this respect. Details of this part of the investigation are reported in section 7.5.5.

7.1.3 Instruments for analyzing stimulated recall data

7.1.3.1 Function of the instruments

The main goal of the stimulated recall procedure was to detect whether there were differences in interactive cognitions between the three experimental groups. All attention was focused upon the two educational theories that were involved in this investigation. In this respect the present investigation differs from most studies of teachers' interactive thoughts done up to now. The majority of these studies tried to depict teachers' interactive cognitions as completely as possible, thereby using generic educational categories like 'goals', 'pupil-activities', etc. They tried to give a complete description of teachers' interactive thought processes that occurred in a 'natural environment'. The most salient characteristic of the present study is that in the first place a treatment was introduced, and subsequently, during the investigation into the effects of the treatment only the two educational theories that are incorporated into the treatment are taken into consideration. Therefore generic educational categories were not used in the analysis of the stimulated recall data. Only categories were used that were directly linked to the two educational theories.
The core question that has to be answered with the help of the instrument is 'to what degree do the teacher utterances, expressed during stimulated recall, refer to the two educational theories'. Thereby the two educational theories are specified into the 12 (Advance Organizer model) and 8 (Role Playing model) theory elements as described in section 6.1.2. Starting from the theory elements, the first task is to establish how theory elements can be detected in teacher utterances. It was necessary to indicate how references to each theory element could be identified.

7.1.3.2 Characteristics of the instruments

Basically there are several ways to attain the goal described in section 7.1.3.1. One possibility might be giving a definition of every theory element that is so complete and exhaustive that it can be ascertained whether each teacher utterance refers to that theory element or not. During the try-outs it appeared to be very difficult to formulate that kind of exhaustive and comprehensive definition, even if the definition was extended to an unusual length. In this investigation the choice was made for another approach which is frequently used in this kind of study and which in content analysis is termed as analysis by 'extensional lists' (e.g., Krippendorff, 1980). In this approach every category is described by a short definition, followed by a list of examples that specify that particular category. In this way a detailed picture of the category emerges, without the pretension of having an all-encompassing definition. The usefulness of this approach can of course only be assessed on the basis of the degree to which unambiguous classifications can by made. In the present investigation an instrument of this type was developed for both the Advance Organizer model and the Role Playing model. After four try-outs two instruments resulted that were sufficiently useful, unequivocal and reliable. The data of six teachers (one teacher from each of the experimental groups from both primary and secondary teachers' colleges) were used to construct the list. Below is an example of one theory element from the Role Playing lesson. A complete text of both instruments can be found in Appendix III *). This example concerns the theory element 'Identification with the story characters':

> This element is coded when the teacher refers to actions or behaviors to promote the pupils' identification with the main characters of the story. This can occur before or during the role playing. Examples:
> 'I thought
> - the pupils have to identify with the story characters'
> - how will I make it clear to them that they have to place themselves in the role, the story?'
> - I have to give him/her the feeling that from now on he/she is the actor'
> - I will address him/her in his/her role'
> - from now on I will call the players by their role name'
> - I have to interrogate the actors about their roles'

*) See footnote on page 84.

- I chose him because he gave a lot of examples and identified himself with his role'
- the pupils should address each other by their role names'

This theory element is also coded when the teacher contemplates the way actors identify or have identified themselves with the roles. Example: 'I thought she identifies herself perfectly with the role'. It will be clear that the teachers, instead of using the term 'thought' can also use terms like 'supposed', 'guessed', believed', 'knew', etc, to refer to their interactive cognitions.

From this example (and from the remarks that follow) it is obvious that the ability to employ these instruments is dependent on two conditions. In the first place one must have a thorough knowledge of the educational theory involved. Teachers rarely report about their interactive cognitions in the same phrases that are used in the theory element of the concerned educational theory (like in the first example of the extensional list just given). In the vast majority of the cases interactive cognitions are reported in the teachers' own terms, even when these interactive cognitions refer to elements from the educational theory. In the latter case the coder must have sufficient knowledge of the educational theory to interpret the teacher utterance as 'theory-related'.

Secondly, the coder must have a precise knowledge of the content of the lesson the teacher is referring to. In most of the cases a theory-related teacher utterance will be embedded in an expression that bears upon the content of that particular lesson. For example, the teacher will in the case of progressive differentiation in the Advance Organizer model say "here I thought I should give the three kinds of needle-leaved trees" instead of "here I thought about going from the more general to the more specific". So the coder must know all the details of the lesson the stimulated recall refers to. In this study this problem was resolved by simultaneously running the audiotape with the stimulated recall data and the videotape with the lesson itself. This enabled the coder to determine the lesson-episode to which every teacher utterance referred. This led to a complete and detailed account of the meaning of every teacher utterance.

The fact that using these instruments requires a thorough knowledge of both the educational theory and the content of the lesson is certainly not seen as a negative characteristic of these instruments. On the contrary, it is believed to be typical of every instrument that is supposed to measure the real, by definition context-bound, interactive teacher cognitions. It is doubtful whether in that case simple instruments that can be used after a limited training period can be adequate. The very explicit coding rules and the reliability sufficiently guarantee that the procedure followed here is reproducible.

7.1.3.3 Coding

Each time the teacher stopped the videotape and reported about his or her thought process was considered one separate 'thought utterance'. Every thought utterance, as recorded on audiotape during stimulated recall, was copied out literally on a separate card. The cards were numbered consecutively. Those teacher utterances that, on the basis of the criteria, were considered non-interactive were excluded from further analysis. If a teacher utterance referred to a particular theory element, the number of that theory element (cf. section 6.1.2) was recorded on the card.
References to two theory elements on one particular card were recorded as such. It is essential to notice that referring or not referring to a theory element was the only characteristic for coding the teacher utterances. All other characteristics were ignored. It would have been possible to make, analogous to other studies in this field, distinctions that are orthogonal to the list of theory elements. For example, while using the Advance Organizer model and working from the more general to the more specific (theory element no. 4), the teacher can focus mainly on pupil activities, but also on, for instance, the goals of that part of the lesson or on other components of the teaching-learning-process. These questions were left out of consideration in this investigation. These instruments are focused on just one aspect of the information that is present in the teacher utterances: the degree to which these utterances refer to the theory elements.

The redundancy with which some teachers reported about their thought processes turned out to be an important problem. If two teachers, at comparable episodes in their lessons, have had similar interactive cognitions, they can vary widely in the degree of detail of their reporting about these cognitions. If this affects only the length of the teacher utterance, one of the teachers reporting in more details and particularities, there will be no problems. The more detailed and the more concise teacher utterance will be coded in the same way. A problem arises when a teacher, at different moments of the stimulated recall interview, restates the same theory-related utterance (i.e., the utterance referring to the same episode in the lesson), thereby using various phrasings. This happened frequently in the stimulated recall data. For instance, when the teacher starts presenting the Advance Organizer, he reports about the related interactive cognitions, but after a short time (during the presentation of the Advance Organizer) he makes a remark about his interactive cognition that is almost identical to the first one and refers to the same lesson-episode. This posed the problem that those teachers who were inclined to repeat the same information gained higher scores on particular theory elements than those teachers who confined themselves to a

single reporting. It was decided to solve this problem with the help of the information about the lesson content that was available in the videotapes (cf. Colker, 1984, for a related type of solution). If during stimulated recall the same theory-reference (i.e., the theory-related teacher utterance referring to the same event in the lesson) is just repeated, that theory-reference is counted only once in the final coding. So in the final comparison between the experimental groups not the raw stimulated recall scores are used, but 'corrected' scores. It appeared that this correction led to a substantial reduction in the scores. The scores of the teachers (i.e., the total number of times a theory reference was coded from their stimulated recall protocols) were on the average reduced to 69% of the original, uncorrected, scores. The average corrected score for each educational theory and for each experimental group is given in Table 1. The corrected score, expressed as a percentage of the original, uncorrected score is given between brackets.

Table 1 Average corrected stimulated recall-scores. Between brackets the same scores expressed as a percentage of the uncorrected ones.

Experimental Group	Role Playing	Advance Organizer	Total
TT	37.6 (60%)	43.6 (69%)	(65%)
T	22.3 (65%)	19.4 (74%)	(70%)
C	9.7 (74%)	7.5 (69%)	(72%)
Total	(66%)	(71%)	(69%)

From this Table it appears that the reduction caused by the correction was the most drastic with the Theory & Tape-group and the least with the Control-group. So, employing this correction influences the results of this investigation in a conservative way: the differences between the three experimental groups become smaller.

7.1.3.4 Reliability

In order to decide unequivocally whether teacher utterances could be considered 'interactive' or not, a set of decision-rules was used. Most of these rules were adopted from Marland (1977). The complete set of rules can

be found in Appendix IV.
Generally speaking, the distinction between interactive and non-interactive is so self-evident and was so clearly discernable from the stimulated recall protocols that there were no problems in categorizing the teacher utterances. The set of decision-rules was mainly useful in dubious cases. The percentage of agreement between the two coders was high: 97% with the Advance Organizer model and 96% with the Role Playing model.

The fact that all teacher utterances were copied out literally has no doubt facilitated the coding process. Because every teacher utterance could be reflected upon without time constraints, a very well-considered coding was possible. This undoubtedly had a positive influence on the reliability of the coding of the teacher utterances. In section 7.1.3.2 it was indicated that the final instruments were constructed in four try-outs. This led to the development of a set of coding-rules that made reliable coding possible. The reliability was, both for the Advance Organizer instrument and the Role Playing instrument, determined with the stimulated recall-data of 6 teachers (one teacher from each of the experimental groups from both primary and secondary teachers' colleges). The final agreement between the two coders, expressed in Cohen's Kappa, was .85 for the Advance Organizer instrument and .87 for the Role Playing instrument.
The sets of all coding rules for both instruments can be found in Appendix III.

7.1.4 Results

7.1.4.1 Differences between the experimental groups

The main question of the present investigation refers to the differences between the experimental groups concerning the number of theory elements in their interactive thinking. The preceding sections reported about the way in which this question has been focused on the interactive cognitions about the selected theory elements that were verbalized during stimulated recall. Besides, it will be clear that we confine ourselves to the interactive teacher cognitions (cf. section 7.1.2.1). Moreover, the results that are presented here refer to the 'corrected' stimulated recall-scores, i.e., the scores from which repetitions have been eliminated (cf. section 7.1.3.3). In Table 2 and 3 the means and standard deviations for each theory element of each of the three experimental groups are presented for the Advance Organizer lesson and the Role Playing lesson respectively (for the meaning of the theory elements cf. section 6.1.2).

Table 2 Mean stimulated recall scores and standard deviations for each theory element for each of the three experimental groups (Advance Organizer model).

	Experimental Group					
	TT		T		C	
Theory element	M	SD	M	SD	M	SD
1	1.2	0.4	0.3	0.5	0.3	0.5
2	1.3	0.5	0.3	0.5	0	0
3	1.8	1.2	0.6	0.5	0	0
4	8.3	3.3	5.5	2.3	4.0	1.9
5	5.1	3.1	3.2	1.8	1.0	1.2
6	3.9	2.2	0.8	1.6	0	0
7	3.8	1.7	1.0	1.2	0	0
8	3.7	2.0	1.5	2.0	0.4	0.7
9	2.6	1.6	2.2	1.6	0	0
10	4.1	1.3	2.1	1.8	1.1	1.3
11	6.1	4.0	1.6	1.3	0.7	1.3
12	1.7	1.4	0.3	0.5	0	0
Total	43.6	12.5	19.2	5.0	7.5	2.8

Table 3 Mean stimulated recall scores and standard deviations for each theory element for each of the three experimental groups (Role Playing model).

	Experimental Group					
	TT		T		C	
Theory element	M	SD	M	SD	M	SD
1	9.3	1.5	7.2	2.3	3.5	2.8
2	4.2	1.5	2.5	1.7	1.3	1.6
3	3.9	2.1	3.3	1.4	1.0	1.2
4	5.4	2.0	4.5	1.7	0.6	0.8
5	3.1	2.2	0.2	0.6	0.1	0.3
6	0.8	0.8	0	0	0.3	0.7
7	4.6	3.0	2.3	1.3	2.8	2.0
8	6.4	2.6	2.3	1.9	0.1	0.3
Total	37.6	9.0	22.3	4.9	9.7	5.3

Visual inspection of these data reveals that there is a clearly visible tendency, the TT-group gaining the highest scores, followed by the T-group, followed by the C-group. Not only the total scores but also the scores per

theory element follow this tendency. There are only two instances where this tendency does not hold: at theory element 6 and 7 of the Role Playing model, the C-group obtains a higher score than the T-group. The TT-group obtains the highest score at all theory elements.
Of course the low scores of the C-group are not too astonishing: this group has not had any influence from the two educational theories. So the scores obtained by this group can be considered a kind of baseline; even if one has not studied a particular educational theory, one thinks to a certain degree 'in accordance' with that theory, just on the basis of 'common practice' of all teachers. In that sense the scores of the C-group can be considered indicative of the degree of overlap between specific cognitions that are related to studying this particular theory and the cognitions of the ordinary teacher. If that overlap had turned out to be zero, it would have indicated that this educational theory was far remote from the usual teacher cognitions.
By far the most interesting is the comparison between the TT-group and the T-group. These groups spent an equal amount of time on the educational theories. In the comparison between the TT-group and the T-group the surplus value of the video-treatment, compared to studying educational theory in the traditional way, is at issue. A preliminary inspection of the data suggests that there is such a surplus value.

The most obvious way to analyze the differences between the three experimental groups is one-way analysis of variance. However, it appears that the assumption of homogeneity of variance in the three experimental groups is not met in most of the cases: Bartlett's test (at a .05 level of significance) reveals that in the Advance Organizer model 6 out of the 12 theory elements are heteroscedastic. In the Role Playing model 6 out of the 8 theory elements are heteroscedastic. Also when the analysis is confined to the TT- and the T-group, about 1/4 of the theory elements (of both the Advance Organizer and the Role Playing model) are heteroscedastic. This pertains to theory elements 3, 11 and 12 of the Advance Organizer model and theory elements 5 and 7 of the Role Playing model. Although the data of the remaining theory elements could have been analyzed with analysis of variance, for the sake of comparability and interpretation of the results, all data were analyzed with nonparametric techniques. The Kruskal-Wallis test is the most obvious choice for analyzing the data of the three experimental groups simultaneously. The Advance Organizer data and the Role Playing data are reported in Table 4 and 5; the χ^2 values that are reported have been corrected for ties. To facilitate visual inspection, all p-values that are statistically significant at 0.05 are marked * and all p-values that are statistically significant at 0.01 are marked **.

Table 4 Results of the Kruskal-Wallis test on the stimulated recall data of the three experimental groups (Advance Organizer Model).

Theory element	n	x^2	p
1	30	14.0	0.0009 **
2	30	21.2	0.0000 **
3	30	20.3	0.0000 **
4	30	8.6	0.0135 *
5	30	14.9	0.0006 **
6	30	20.9	0.0000 **
7	30	21.7	0.0000 **
8	30	13.8	0.0010 **
9	30	17.3	0.0003 **
10	30	13.2	0.0014 **
11	30	16.4	0.0003 **
12	30	15.0	0.0005 **
Total	30	25.8	0.0000 **

Table 5 Results of the Kruskal-Wallis test on the stimulated recall data of the three experimental groups (Role Playing Model).

Theory element	n	x^2	p
1	30	15.1	0.0005 **
2	30	10.5	0.0053 **
3	30	14.3	0.0008 **
4	30	19.1	0.0001 **
5	30	22.4	0.0000 **
6	30	8.8	0.0125 *
7	30	4.4	0.1132
8	30	21.1	0.0000 **
Total	30	23.3	0.0000 **

From this analysis it appears that for practically all theory elements there are statistically significant differences between the three experimental groups. The only exception is theory element 7 of the Role Playing model. This appears to be a theory element that is important to every teacher who gives a role playing lesson, unrelated to this particular educational theory: 'degree of realism of the role playing performed'. For all other theory elements as well as for the total scores it appears that all differences are statistically significant.

As noted earlier the low C-group scores are not surprising: if there has not been any theory-related treatment, it can be expected that relatively few theory-related cognitions will be found. It is possible that the very significant differences that have been presented in Tables 4 and 5 were caused by the very low C-group results. Thus a separate analysis of the differences between the TT- and the T-group should be made. An equally valid reason to do this is the theoretical importance of this comparison: it concerns the surplus value of the video-treatment.

In discussing the data from Table 2 and 3 it has already been noted that there are no differences in the 'wrong' direction between the TT-group and the T-group: with both the Advance Organizer model and the Role Playing model, group TT obtained higher average scores than group T for every theory element. This is especially important because in this kind of analysis the overall tendency is relatively important. The nature of the data (separate theory elements) requires making a number of single comparisons between the experimental groups. Because statistically significant differences may occur solely on the basis of chance, results on single theory elements have only limited meaning. If, in interpreting the overall tendency, all differences are in the same direction, this enhances the consistency and plausibility of the conclusions.
For comparing the group TT and the group T data, the Mann-Whitney U-test is the most appropriate. The results of these tests are presented in Tables 6 and 7; the obtained values have been corrected for ties.

It can be concluded that for the Advance Organizer model the difference between the TT- and the T-group is significant at (at least) the 0.05 level for 9 of the 12 theory elements; for the Role Playing model, 6 of the 8 theory elements differ at the 0.05 level. Although this is a reduction compared to the results of the Kruskal-Wallis analysis for the three groups simultaneously that showed a significant difference for almost all theory elements (cf. Tables 4 and 5), the picture is still rather unambiguous: all differences are in the 'right' direction and three-quarters of the differences are statistically significant. This indicates the surplus value of the video-treatment, compared to the purely verbal transmittance of educational theory. That this effect can be demonstrated with such small samples makes it all the more convincing.
As to the character of the theory elements that have no significant difference between the TT- and T-group, it apparently concerns theory elements that can be transmitted equally well by purely verbal means as by video-methods. For the Advance Organizer model this holds for the notion of working from the general to the specific (theory element 4) and illustrating these differentiations with appropriate schemes (theory element

Table 6 Means of the stimulated recall scores of the TT- and the T-group and results of the Mann-Whitney U-test (Advance Organizer model).

Theory element	M_{TT}	M_T	z	p
1	1.2	0.3	3.23	0.0012 **
2	1.3	0.3	3.28	0.0011 **
3	1.8	0.6	2.75	0.0060 **
4	8.3	5.5	1.94	0.0524
5	5.1	3.2	1.39	0.1640
6	3.9	0.8	3.19	0.0014 **
7	3.8	1.0	3.33	0.0009 **
8	3.7	1.5	2.28	0.0226 *
9	2.6	2.2	0.54	0.5902
10	4.1	2.1	2.47	0.0136 *
11	6.1	1.6	3.03	0.0024 **
12	1.7	0.3	2.62	0.0088 **
Total	43.6	19.2	3.78	0.0002 **

Table 7 Means of the stimulated recall scores of the TT- and T-group and results of the Mann-Whitney U-test (Role Playing model).

Theory element	M_{TT}	M_T	z	p
1	9.3	7.2	2.26	0.0239 *
2	4.2	2.5	2.00	0.0460 *
3	3.9	3.3	0.32	0.7461
4	5.4	4.5	0.78	0.4331
5	3.1	0.2	3.70	0.0002 **
6	0.8	0	2.81	0.0049 **
7	4.6	2.3	2.11	0.0353 *
8	6.4	2.3	2.94	0.0033 **
Total	37.6	22.3	3.92	0.0010 **

5). Also the idea of asking the student to summarize the main points of parts of the lesson (theory element 9) can apparently be effectively transmitted by verbal and written instruction. This is an empirical finding. On the basis of the present data it is impossible to give a theoretically sound explanation of the fact that exactly these theory elements can be transmitted equally well by verbal and written means. Of

course the same holds for the theory elements from the Role Playing model that showed no significant differences between the TT- and the T-group: 'Letting pupils experience that there are many ways to define a problem, to solve it, to play a role, etc,' (theory element 4), and 'Concentrating on the thoughts and feelings of the players' (theory element 5).

The degree to which the C-group is different from the TT- and T-groups indicates the degree to which the respective experimental effects differ from 'ordinary' teacher cognitions. In the comparison between the TT- and the C-group it turns out that for the Advance Organizer model all theory elements differ significantly, while for the Role Playing model this is the case for 6 of the 8 theory elements. Comparing the T- with the C-group results in 4 (out of 12) significant differences for the Advance Organizer model and 4 (out of 8) significant differences for the Role Playing model. Also here the final conclusion must be that the video-treatment-group differs significantly from the other experimental groups. Tables 8 and 9 present the data of the additional comparisons.

Table 8 Comparisons between the experimental groups and the control group data of the Advance Organizer model (Mann-Whitney U-test).

	TT- versus C-group		T-versus C-group	
Theory element	z	p	z	p
1	3.23	0.0012 **	0	1.0000
2	4.15	0.0000 **	1.83	0.0671
3	4.10	0.0000 **	2.85	0.0043 **
4	2.70	0.0069 **	1.34	0.1814
5	3.57	0.0004 **	2.79	0.0053 **
6	4.05	0.0001 **	1.82	0.0682
7	4.06	0.0000 **	2.49	0.0128 *
8	3.61	0.0003 **	1.37	0.1699
9	4.05	0.0001 **	3.42	0.0006 **
10	3.41	0.0007 **	1.34	0.1816
11	3.57	0.0004 **	1.67	0.0956
12	3.42	0.0006 **	1.83	0.0671
Total	3.79	0.0002 **	3.79	0.0002

Table 9 Comparisons between the experimental groups and the control group data of the Role Playing model (Mann-Whitney U-test).

	TT- versus C-group		T- versus C-group	
Theory element	z	p	z	p
1	3.27	0.0011 **	2.74	0.0061 **
2	3.03	0.0024 **	1.56	0.1186
3	3.31	0.0009 **	3.70	0.0017 **
4	3.79	0.0002 **	3.70	0.0002 **
5	3.87	0.0001 **	0.07	0.9422
6	1.64	0.1010	1.45	0.1468
7	1.27	0.2050	0.70	0.4851
8	3.93	0.0001 **	3.20	0.0014 **
Total	3.78	0.0002 **	3.52	0.0104 **

Comparisons between the experimental groups took place by counting the number of times each theory element occurred in the stimulated recall interview, and computing the means. Although it is evident that if a theory element occurs relatively often there is a relatively important 'cognitive use' of that element, counting the number of occurrences remains somewhat arbitrary. This is even the case if the scores are corrected in the way described in section 7.1.3.3, leading to excluding from the analysis those thought utterances that are only repetitions or paraphrasings of earlier ones. When averages of an experimental group are computed, the counting-procedure can lead to 'compensating' of one teacher for another. In a hypothetical situation two teachers who each use a particular theory element three times will contribute the same to the general group means as two teachers of which one uses the theory element six times and the other does not use it at all. From a theoretical point of view, there is no clear-cut solution to this problem. It could be argued that it is of primary importance to know whether a teacher has used a theory element at least one time or not at all. In any case, the teacher who has used the theory element once has demonstrated an ability to employ the theory element in his or her cognitions during teaching. In this view the difference between the occurrence or non-occurrence of a theory element would even be more critical than the number of times the theory element occurred. It is therefore essential to detect how many of the 12 (Advance Organizer model) or the 8 (Role Playing model) occur at least once in the stimulated recall interview. Subsequently it can be determined whether there are in this respect differences between the experimental groups. The means, standard deviations and 95% confidence intervals for each of the three experimental groups are provided in Tables 10 and 11.

Table 10 Average number of theory elements that occur at least once in teachers' interactive cognitions, specified for the three experimental groups (Advance Organizer model).

Experimental Group	n	M	SD	95% confidence interval
TT-group	10	11.8	0.4	11.4 to 12.1
T-group	10	6.9	1.4	5.9 to 7.9
C-group	10	2.9	1.2	2.0 to 3.8

Table 11 Average number of theory elements that occur at least once in teachers' interactive cognitions, specified for the three experimental groups (Role Playing model).

Experimental Group	n	M	SD	95% confidence interval
TT-group	10	7.6	0.5	7.2 to 8.0
T-group	10	5.7	0.8	5.1 to 6.3
C-group	10	3.5	1.5	2.4 to 4.6

There are obvious differences between the experimental groups for both the Advance Organizer model and the Role Playing model. Tested with the Kruskal-Wallis one-way analysis of variance the differences were significant at 0.001 for both theories (χ^2 being 26.1 and 22.3 respectively). It can be concluded that the treatment not only influences the number of times theory-related cognitions occur during interactive teaching, but also the number of theory elements that, on the average, occur ar least once during interactive teaching, i.e., the difference between not utilized and utilized.

Given the fact that there are differences between the experimental groups concerning the degree to which theory-related interactive cognitions occur, the question arises whether there is any relationship with the type of educational theory. It is conceivable that a certain treatment is relatively more effective with a particular educational theory. In fact, the matter of interaction between 'type of treatment' and 'type of theory' is at stake here. Visual inspection of Table 12 indicates that there is a slight interaction.

Table 12 Average stimulated recall score, specified for type of treatment and type of educational theory.

	TT-group	T-group	C-group	Total
Advance Organizer Model	43.6	19.4	7.5	23.5
Role Playing Model	37.6	22.3	9.7	23.2
Total	40.6	20.9	8.6	23.35

It should be noted that the almost identical total means of the Advance Organizer model and the Role Playing model is purely accidental. The instruments for measuring stimulated recall after the Advance Organizer lessons and after the Role Playing lessons were developed independently. So direct comparisons between the scores is meaningless.
An analysis of variance reveals that the slight interaction between type of treatment and type of educational theory that is visible in Table 12, is not statistically significant (cf. Table 13).

Table 13 Results of the ANOVA on the effects of type of theory and type of treatment on stimulated recall scores.

	d	MS	F	p
Main effects	3	3476.3	64.96	0.000
Type of educ. theory	1	1.4	0.03	0.874
Type of treatment	2	5213.8	97.42	0.000
2 way interactions				
Type of theory x Type of treatment	2	122.5	2.27	0.111
Explained	5	2134.8	39.9	0.000
Residual	54	53.5		

Thus, it cannot be concluded that the type of treatment has differential effects with the two educational theories that have been used in this investigation.

7.1.4.2 Differences between primary and secondary teachers' colleges

Originally the video-materials were developed for use at both teachers' colleges for primary and teachers' colleges for secondary education. Deliberately no topics or subjects were included that are unsuited for primary education pupils (foreign languages, advanced mathematics, etc). All lessons from which episodes were included in the treatment materials were given to 13 year old pupils, this being an acceptable 'compromise' between the audience for primary and for secondary teacher education. So it was evident that also in this investigation, which focused on detecting the effects of these materials, both primary and secondary teacher education teachers should be involved. Of the total sample (30) half of the teachers were from primary teachers' colleges and half of the teachers from secondary teachers' colleges. The 15 teachers from each of the two types of colleges were randomly assigned to the three conditions (cf. section 6.2). Although the normal teacher education programs of the two types of teachers' colleges were of course different, there were no reasons to believe that there would be differences in treatment-effects between the teachers from primary and from secondary teacher education colleges. The principles of the two educational theories were regarded generally applicable. Thus, the hypothesis was that there would be no differences in the degree to which theory-related cognitions could be found in teachers from primary and teachers from secondary teacher education. The means of the two types of teachers' colleges are presented in Table 14, specified for the theory elements of the two theories.

It appeared that only the difference for theory element 4 of the Advance Organizer model ('general to specific') was statistically significant: $t = 2.30$ $df = 24.75$ $p = 0.030$. For all other theory elements there were no significant differences between teachers from primary and from secondary colleges. It is clear that no conclusions can be based on a single significant difference.
The above conclusion refers to the groups of primary and of secondary teachers' colleges as a whole, i.e., the three experimental groups taken together. Because the C-group had very low scores for both the Advance Organizer model and the Role Playing model, it is possible that the general conclusion of 'no difference' was mainly caused by the C-group. To check this, a comparison was made between the teachers from primary and from secondary teachers' colleges, now excluding the C-group from the analysis. The results were identical to the former analysis: only for theory element 4 of the Advance Organizer model ('general to specific') was there a sig-

Table 14 Average total stimulated recall scores for each of the theory elements of the Advance Organizer model and the Role Playing model, specified for teachers from primary and from secondary colleges.

	M Secondary College	M Primary College
Advance Organizer model		
Theory element 1	0.7	0.5
Theory element 2	0.5	0.5
Theory element 3	0.7	0.9
Theory element 4	4.7	7.1
Theory element 5	2.5	3.7
Theory element 6	1.4	1.7
Theory element 7	1.6	1.6
Theory element 8	1.8	1.9
Theory element 9	1.2	2.0
Theory element 10	2.5	2.3
Theory element 11	3.0	2.6
Theory element 12	0.5	0.9
Total	21.2	25.8
Role Playing model		
Theory element 1	6.1	7.2
Theory element 2	2.9	2.5
Theory element 3	2.5	2.9
Theory element 4	3.5	3.5
Theory element 5	0.9	1.3
Theory element 6	0.5	0.3
Theory element 7	3.1	3.4
Theory element 8	3.3	2.5
Total	22.9	23.5

nificant difference between the two types of teachers' colleges ($t = 2.64$ $df = 15.24$ $p = 0.019$). For all other theory elements from both educational theories the two types of teachers' colleges did not differ.

Lastly an analysis was done to determine whether there was an interaction between type of teachers' college and type of treatment. It appeared that when the total scores were specified for the experimental groups, the TT-teachers from the primary teachers' colleges had higher scores than those from the secondary teachers' college, especially for the Advance Organizer model (cf. Table 15).

Table 15 Comparison between the average total scores of the teachers from primary and from secondary teachers' college in each of the experimental groups, specified for the Advance Organizer and the Role Playing model.

	Advance Organizer model		Role Playing model	
	Secondary	Primary	Secondary	Primary
TT-group	36.2	51.0	35.8	39.4
T-group	19.4	19.4	21.4	23.2
C-group	8.0	7.0	11.4	8.0

The general picture for the average total score is as follows: in the TT-group the teachers from primary teachers' college had higher scores, in the T-group the scores are about the same and in the C-group the teachers from secondary teachers' college had slightly higher scores. An analysis of variance indicated that only with the Advance Organizer model was there an interaction between type of teachers' college and type of treatment ($F = 4.116$ $df = 2$ $p = 0.029$). The next question was of course whether this same interaction-effect could also be found with the separate theory elements. This turned out not to be the case: for none of the theory elements was there a significant interaction. Apparently the teachers from primary teachers' colleges gained proportionally slightly higher scores all along the line, but only the cumulative effect (as measured in the average total score) led to a significant interaction. With the Role Playing model there was no significant interaction effect, not even for the total score. There is no obvious interpretation of the interaction between type of treatment and type of teachers' college with the Advance Organizer model. Apparently teachers' from primary teachers' colleges were, when confronted with this type of video-treatment, slightly more inclined to assimilate the theory; combined with a somewhat higher 'baseline' of the secondary teachers' college (cf. the C-group), this could lead to a significant interaction. However, in view of the fact that this interaction could be traced in none of the separate theory elements, there are no solid conclusions that can be based on this finding.

7.1.4.3 Sequence-effects

The teachers that participated in the study were completely unfamiliar with the stimulated recall technique. It is conceivable that repeated employment of this technique with the same person might have a distinct influence on the results obtained. One might expect that after some time people become

gradually more proficient in adequately externalizing their thoughts in the stimulated recall setting. If this were the case, this would result in relatively higher scores at the second stimulated recall interview. An opposing mechanism would be in effect if one might, because of the experience of novelty on the first stimulated recall interview, try harder at that first interview to adequately externalize one's thoughts, compared to the second one. If after some time one experienced the stimulated recall as being either dull or too tiresome, this would mean putting less effort into the task, resulting in relatively lower scores at the second stimulated recall session.

The design controlled for 'learning effects', either in the positive or the negative sense: within each of the experimental groups, half of the teachers started with the Advance Organizer lesson and half of the teachers with the Role Playing lesson, thereby also effecting an equal distribution over the two types of teachers' colleges. Although the results of this investigation could by no means be influenced by unintended learning effects, it was interesting to find out whether any learning effects occurred. It was especially informative in view of future research, because it concerned the relevance of controlling for these kinds of effects in the research design. The mean scores for all theory elements of both theories are given in Table 16. The scores in the first column refer to the stimulated recall interviews after those lessons that were the first lessons given by the teachers and the second column to the stimulated recall interviews after the second lessons.

From a direct comparison (t-test) it appears that none of these differences is statistically significant. The picture changes slightly when analysis of variance is done with both lesson-sequence and type of treatment as independent variables. It shows that the sequence-effect is significant for theory element 12 of the Advance Organizer model ($F = 4.267$ $df = 1$ $p = 0.050$) in favor of the 'second lesson' (i.e., those for whom this stimulated recall session was the second one gaining higher scores). On the other hand, with the Role Playing model the only significant differences are in favor of the 'first lesson', namely at theory element 5 ($F = 8.393$ $df = 1$ $p = 0.008$) and theory element 6 ($F = 5.444$ $df = 1$ $p = 0.028$). So the overall picture of the sequence-effects is inconsistent, in the sense that the effects are in favor of the 'second lesson' with the Advance Organizer model and in favor of the 'first lesson' with the Role Playing model. However, in view of the number of comparisons made here, the number of significant differences is certainly too small to make any inferences

Table 16 Average stimulated recall scores for all theory elements of both theories, specified for the 'first given' and 'second given' lesson.

	First lesson	Second lesson
Advance Organizer model		
Theory element 1	0.73	0.47
Theory element 2	0.60	0.46
Theory element 3	0.87	0.73
Theory element 4	5.60	6.27
Theory element 5	2.87	3.33
Theory element 6	1.67	1.47
Theory element 7	1.40	1.80
Theory element 8	1.87	1.87
Theory element 9	1.73	1.47
Theory element 10	2.40	2.47
Theory element 11	2.27	3.33
Theory element 12	0.40	0.93
Total	22.40	24.60
Role Playing model		
Theory element 1	7.33	6.00
Theory element 2	2.73	2.60
Theory element 3	3.07	2.40
Theory element 4	3.80	3.20
Theory element 5	1.67	0.60
Theory element 6	0.60	0.13
Theory element 7	3.67	2.80
Theory element 8	2.93	2.93
Total	25.80	20.60

about learning effects. So the final conc'usion must be that it has not been possible to find evidence for any learning effects, either positive or negative.

7.1.4.4 Effects of class size

The teachers gave their lessons about one month after they received instruction in the two educational theories. Because it cannot be expected that employing the theories can be automatized in such a short time, additional effort and concentration will be required from the teacher. It seems obvious that if the class size is relatively large, the teacher will have relatively less spare energy for that additional concentration.

Although this holds for every educational theory, one would expect this to be especially true for educational theories that set high organizational demands. It is clear that the organizational demands are higher in employing the Role Playing model than in employing the Advance Organizer model. The Role Playing model does not conform to the standard pattern of activity of most classes, thereby running the risk of inducing classroom management problems. It was expected that especially for the Role Playing model there would be a negative relationship between the size of the class and the degree to which elements from the educational theory were employed in interactive teacher cognitions.
The 30 classes that were involved in the investigation were classified as small, medium-sized and large. The criteria were chosen in such a way that three groups of equal size resulted. Classes were considered to be small if there were fewer than 21 pupils in it, medium-sized if there were 21 to 27 pupils and large if there were more than 27 pupils. This resulted in three groups of 10 classes, which were distributed over the three experimental conditions as indicated in Table 17.

Table 17 Distribution of the class sizes over the experimental groups.

	Experimental group			
	TT	T	C	Total
Class size				
small ($\leq$ 20)	3	4	3	10
medium-sized (21-27)	4	4	2	10
large ($\geq$ 28)	3	2	5	10
Total	10	10	10	30

There was no significant unequal distribution over the three experimental groups ($\chi^2 = 2.4$ df = 4 p = 0.6626).
Table 18 gives the results (averages) specified for the various class sizes.
From this Table (and especially from the total average scores) it can be seen that with the Advance Organizer model there are hardly any differences between the experimental groups. With the Role Playing model the relatively low scores of the group of large classes could be an indication of the 'organizational constraint' just discussed. However, if that mechanism was important, there would have been a clear pattern of diminishing scores from the small classes to the large classes group. The relatively high score of

Table 18 Average stimulated recall scores for the theory elements of Advance Organizer model and Role Playing model, specified for the three class sizes.

Class size	≤ 20	21-27	≥ 28
Advance Organizer			
Theory element 1	0.72	0.50	0.54
Theory element 2	0.45	0.50	0.64
Theory element 3	0.72	0.75	0.91
Theory element 4	5.18	6.13	6.55
Theory element 5	2.45	3.50	3.45
Theory element 6	1.18	1.63	1.91
Theory element 7	1.64	2.13	1.18
Theory element 8	1.64	1.63	2.27
Theory element 9	1.36	1.63	1.82
Theory element 10	2.72	2.75	1.91
Theory element 11	3.18	1.88	3.19
Theory element 12	0.45	1.25	0.45
Total	21.72	24.25	24.72
Role Playing			
Theory element 1	6.00	7.20	6.80
Theory element 2	3.40	2.20	2.40
Theory element 3	2.10	4.10	2.00
Theory element 4	3.70	4.40	2.40
Theory element 5	1.40	1.30	0.70
Theory element 6	0.30	0.50	0.30
Theory element 7	3.10	3.70	2.90
Theory element 8	3.30	3.60	1.90
Total	23.30	27.60	19.30

the medium-size group suggests this is not the case.

From one-way analysis of variance it appears that for none of the theory elements (with the exception of theory element 3 of the Role Playing model: $F = 4.32$ $df = 2$ $p = 0.0236$) is there a statistically significant difference between the three class sizes. Of course, no conclusions can be based on the single significant result. So the general conclusion is that there is no significant relationship between the size of the class and the stimulated recall scores on the two educational theories. It can be concluded that employing these educational theories does not lead to such organizational demands that it can be done only in the relatively favorable conditions of the small class. An important factor may have been that also

on the treatment-videotape the classes were complete ones. During the construction of these materials it was decided not to illustrate the theories in reduced classroom situations in order to demonstrate to the teachers that these theories were employable in ordinary classroom situations, with complete classes. Of course in this investigation it could not be determined whether this feature led to the lack of relationship between class size and stimulated recall scores.

7.1.4.5 Dominance of theory elements

In this investigation 'dominance' refers to the degree to which employing theory elements in teachers' interactive cognitions is concentrated on just a small part of all (12 or 8) theory elements. The rationale for looking into this 'dominance' lies in the notion that, ideally, employing an educational theory in one's interactive cognitions does not mean restricting oneself to a single or just a few of the essential theory elements, but instead implies employing a variety of theory elements. In other words, the total stimulated recall score should not be based on the scores obtained on just a few types of theory elements. Consequently, 'dominance' of a few types of theory elements is considered an inadequate use of the educational theory. The basic idea of 'dominance' is from Morine-Dershimer (1984); however, the way in which 'dominance' is detected in the present study is rather different from the procedure utilized by Morine-Dershimer.

In the first place it must be clear that the procedure used in the present study is about relative dominance, i.e., dominance compared to other teachers' dominances. This means, among other things, that calling a theory element 'dominant' for a certain teacher should be independent of his or her total number of theory elements (total stimulated recall score on that theory); this requirement is also important in view of the differences in average total scores between the three experimental groups. In general this requirement meant working with percentages instead of raw scores. This made it possible to make comparisons between teachers regarding the degree to which all of the 12 (Advance Organizer) or 8 (Role Playing) theory elements contributed to their total scores on the stimulated recall on that theory. Because the teachers in the Control-group had very low average total scores on a number of theory elements, the results were difficult to interpret in terms of 'dominance': if a teacher has very low or zero scores on almost all theory elements, getting a moderately high score on one single theory element generates a very high percentage (and consequently a 'dominance') on that theory element. So for the detection of dominances it was more

appropriate to leave the C-group out of consideration and to concentrate on the TT- and T-groups.

It cannot simply be deduced which theory elements should be considered 'dominant' for a teacher from the percentages on each of the theory elements per teacher. There are, after all, theory elements that occur relatively often in general (i.e., with all teachers). For example, theory element 4 of the Advance Organizer model ("general to specific") produced generally high scores; it is a theory element that is referred to relatively often in most of the stimulated recall sessions. It would not be very informative to conclude that this theory element is 'dominant' for almost all of the teachers: as stated at the beginning of this section, we are interested in the relative dominance, the dominance compared to other teachers. In the present study 'dominance' is defined as follows: Starting with the percentages (that express what is the contribution of a theory element to the total score of that teacher), the means and standard deviations (of all teachers of that experimental group) were determined for each theory element. A theory element is considered 'dominant' for a teacher if his or her score (percentage) on that theory element is more then two standard deviations above the mean of that theory element. The number of dominances found in the two experimental groups are presented in Table 19 and 20.

Table 19 Dominances in the TT- and T-group, specified for the theory elements of the Advance Organizer model.

Theory element	TT	T	
1		2	2
2		1	1
3	1		1
4		1	1
5		2	2
6			0
7			0
8		1	1
9		2	2
10			0
11	1		1
12	1		1
Total	3	9	12

Table 20 Dominances in the TT- and T-group, specified for the theory elements of the Role Playing model.

Theory element	TT	T	
1			0
2		1	1
3		1	1
4		1	1
5	1		1
6	1		1
7	1		1
8		0	0
Total	3	3	6

At first sight 'dominance' seems to occur within the Advance Organizer model more often than within the Role Playing model. In the T-group it happens relatively often that just one or a few theory elements contribute proportionally much to the total score of the teacher. At this point the two experimental groups do not differ within the Role Playing model. Whether any statistical importance should be attached to the difference between the TT- and the T-group within the Advance Organizer model was checked with a t-test. The difference appeared to be not significant ($t = 1.47$ $df = 11.85$ $p = 0.168$). So it can be concluded that for the variable 'dominance', as defined in this study, there is no difference between the TT- and the T-group. In other words, the two treatments lead to equally well-balanced use of the educational theories in teachers' interactive cognitions.

7.1.5 Conclusions

In this section we mainly concentrated on the seven research questions that were posed in relation to the teachers' interactive cognitions (cf. Chapter 6.4). The main question concerned the influence of the experimental treatment on the use of educational theory in teachers' interactive cognitions and focused on the difference between the experimental groups as to the number of theory elements in their interactive thinking. From the data just discussed it appears that there is such an influence. A most important finding is that when the three experimental groups are compared, on almost all theory elements the differences are in the 'right' direction, the TT-group gaining the highest score, followed by the T-group, followed by the C-group. Because at the level of the single theory elements significant differences can easily occur on the basis of chance, we focus on the

general tendencies. For almost all theory elements the differences are statistically significant. Since the C-group got no specific treatment in these educational theories, the scores of this group are considered baseline data. Concentrating on the difference between the TT- and the T-group, it appears that these groups differ significantly on about three-quarters of the theory elements. Given the fact that statistical significance also depends on the sample size, this result can be termed remarkable.
If one considers the proportion of the (12 or 8) theory elements that were used at least once in the teachers' cognitions, the tendency is clearly in the same direction: the differences between the experimental groups are significant, with no overlap between the 95% confidence intervals for the means.
We may conclude that the experimental groups differ with respect to employing the educational theories in their interactive cognitions. An even more important conclusion is that this also holds when only the TT- and the T-group are taken into consideration. Apparently, the additional value of the video-treatment is sufficient to cause a difference of this kind. So, research questions a1 and a2 (cf. section 6.4) can be answered in the positive sense.

The relative difference between the TT- and the T-group seems to be somewhat greater for the Advance Organizer model than for the Role Playing model, but this interaction appears not to be statistically significant. So, the conclusion is that the 'advantage' of the video-treatment does not work better for one type of theory than for another (research question a3). Of course this conclusion basically holds for the two types of theories that were at issue here, albeit that these theories were rather divergent (and were in fact from different 'families' of teaching models, as defined by Joyce & Weil, 1980).

As to the possible effects of the intervening variables that were investigated (research questions a4 to a6), this did not lead to surprising results in any of the cases. It appeared that neither the type of teachers' college being primary versus secondary (apart form the interaction effect with the Advance Organizer model, which was already discussed), nor the lesson being the first versus the second one, nor the size of the class being small, medium-sized or large, led to differential experimental effects.
Because there are no effects of intervening variables, no modifications of the conclusions concerning the experimental effects are required. In principle it remains possible that other intervening variables, not included in this study, were in operation. However, in our view, the most

obvious ones were included here. Possible intervening variables that pertain to teachers' implicit theories are investigated in separate analyses; this concerns teachers' appraisal of the educational theory program (section 7.4) and their educational philosophies (section 7.5.3). Also for the research question about the 'dominance' of the theory-elements (s7) it holds that no remarkable results were found: no differences between the relevant experimental groups in the number of such dominances could be established.

The general conclusion is that there is an effect of the experimental treatment, in the sense that the treatment that included both the studying of educational theory and video leads to a more frequent 'use' of educational theory, not only compared to a control group, but also compared to a group that spent the same amount of time on the educational theories but received no video-treatment. This latter surplus value of the TT-treatment manifested itself in the majority of the theory elements that were discerned in this study. Determining the effects of the most obvious possible intervening variables did not necessitate modifying this conclusion.

7.2 Teacher behavior

7.2.1 Introduction

Although the main research questions in this study pertain to the effect of the treatment on teacher cognitions, it was also expected that there would be an effect on teacher behavior. The literature on behavioral effects of protocol-like materials was extensively discussed in Chapter 2. The hypothesis concerning the behavioral effects that was tested in this study rests on a similar line of reasoning: because the teacher can see a particular educational theory 'in operation', thereby understanding the theoretical basis of that behavior, the teacher discerns the practical implications of that theory, which subsequently facilitates employing the theory in classroom behavior. The underlying paradigm is essentially mediational, the theoretical concepts mediating the behavioral employment of the theory (cf. Gliessman & Pugh, 1987). Whether or not the teacher has employed the theory elements in classroom behavior can only be examined in a valid way by observation. Data-gathering for testing the hypotheses on the effects of the treatment on teacher behavior was enormously facilitated by the fact that stimulated recall had been necessary to answer the main research question. For that purpose, video-recordings of all lessons had been made. These video-recordings could of course also be used for obser-

ving and analyzing teacher behavior. Moreover, this procedure was superior to direct observation, in the sense that teacher-behavior could be observed without time constraints, making it possible to reflect upon the behavior and to 'repeat' the behavior as many times as necessary for a careful analysis.
A very important advantage of this procedure, finally, was the possibility to investigate the relationship between the stimulated recall data and the classroom behavior data. Section 7.3 will be devoted to this relationship.

7.2.2 Instruments for analyzing teacher behavior

7.2.2.1 Function of the instruments

The instruments have been devised for determining to what degree the elements from the two educational theories can be found in the classroom behavior of the teachers. Analogous to the function of stimulated recall in relation to teacher cognitions, the goal here is not to depict teacher behavior in general, nor to develop an instrument composed of general observational categories like 'goals', 'pupil activities', et cetera, but of observational categories that are directly derived from the two educational theories. The question that has to be answered with the help of these instruments is: 'to what degree is the behavior displayed by the teacher during the lessons consistent with the educational theories'. This phrasing avoids the problem of whether the teacher consciously tried to act according to the theory. Influencing teachers' cognitions is the subject of section 7.1. Research into the relationship between teacher cognition and teacher behavior will be reported in section 7.3.

Because the two educational theories were taken as the point of reference and the teachers' behavior is surveyed according to these two theories, two separate observation instruments were developed, one for the Advance Organizer model and one for the Role Playing model. The function and character of these two instruments is completely analogous.

7.2.2.2 Characteristics of the instruments

To ensure that the instruments depicted the degree of theory-consistent behavior of the teacher, instrument construction started from the elements of the two theories. The natural choice was, as with the stimulated recall, to start from the 12 and 8 theory elements that were considered the core of

the Advance Organizer theory and the Role Playing theory respectively. Next the notion 'theory-consistent' had to be operationalized. In fact it had to be established for every theory element, how it could be determined whether a particular teacher behavior was 'theory-consistent'. The most complicating factor was that there are generally a number of ways in which a teacher, in a specific teaching situation, can 'comply with' the theory. For example, 'promoting identification of the pupils with the story characters' (theory element 2 of the Role Playing model) is at issue when the teacher explicitly asks the pupils to immerse themselves in some leading character from the story, but also when one of the players is called by his or her rolename.
For each of the two theories a very detailed set of rules was developed that prescribed in a detailed way when certain teacher behaviors should be termed 'theory-consistent'. If necessary, a rule is accompanied by an elucidation that gives reasons for the choices that were made. For a complete list of all rules and elucidations the reader is referred to Appendix V.
As a matter of course, those who are to utilize the observation instruments must have a thorough knowledge of the educational theories. One should be able to recognize the theory-consistent behavior in a great variety of concrete manifestations. In all cases the theory-consistent behavior is 'concealed' in the subject matter treated by the teacher at that moment. The requirement of thorough knowledge of the educational theory was already discussed with reference to the instruments for analyzing the stimulated recall data (cf. section 7.1.3.2); the fact that this requirement certainly was not considered a negative aspect of these instruments was also already put forward there. If the goal is to depict theory-consistent behavior, broad instruments of a general nature are not sufficient.
Construction of the final instruments was very time consuming. In three try-outs they were revised until they were sufficiently unequivocal.

7.2.2.3 Coding

After construction of the instruments the videotapes were analyzed by a coder who was ignorant of experimental group membership of the teachers involved. The videotapes analyzed were the same ones that were used to elicit stimulated recall: the tapes of 30 teachers, 10 per experimental group, each teacher having given one Advance Organizer lesson and one Role Playing lesson. Coding was done with the help of a coding form, which comprised 12 (Advance Organizer) or 8 (Role Playing) columns, one column per theory element. In the left margin there was a time scale, dividing the total lesson time into periods of 10 seconds. On the basis of the counter

of the video-recorder, the lesson was divided into periods of 10 seconds. Coding the lesson meant that every time a theory-consistent behavior was seen in the lesson, it was indicated in the correct column at the right time location. This point marks the starting point of that theory-consistent behavior. Figure 1 shows a small part of the form on which the teacher behavior during a Role Playing lesson was coded.

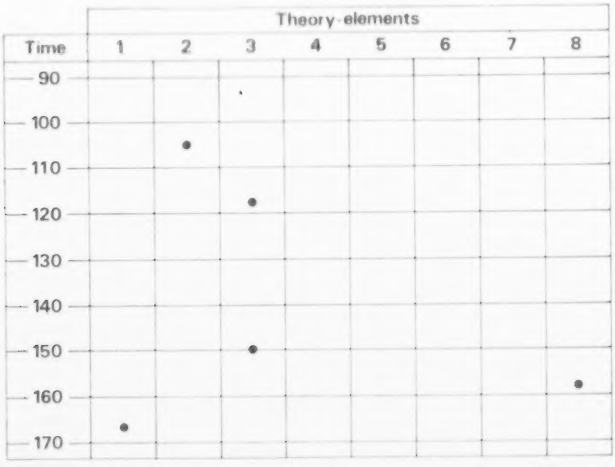

Figure 1 Example of a small part of the teacher behavior coding form of a Role Playing lesson.

This procedure results in a chronologically correct overall picture of all theory-consistent teacher behaviors in a lesson. The form is especially useful because the data about the teacher's cognitions in that same lesson can be fit into it. This will be demonstrated in section 7.3.

With the Role Playing model there was a problem how to code repetition of almost identical behavior, particularly when this behavior was related to accidental circumstances. For instance, if the teacher successively compares the role playing behavior of some pupils to real-life (theory element 7 from the Role Playing model) he or she should gain a higher score than teachers who confine themselves to a single pupil in this respect. However, there is no point in successively comparing the role playing behavior of eight pupils to real-life situations; discussing the eighth pupil's be-

havior can add little to what is theoretically meant by 'comparing role playing to real life'. It was therefore decided that a maximum should be set, above which the teacher would gain no additional score. It was decided that when after role playing the teacher compares the behavior of the pupils to real-life situations, the maximum score on theory element 7 could be 3. This rule prevents gaining a high score on accidental grounds, in this case the number of pupils in the role playing situation (there are no role-playings with fewer than 3 players).
There were some additional problems which required this kind of decision. An attempt was made to ground these decisions on the goals and principles of the theory concerned. Of course these decisions and their justifications are explicitly stated in the set of coding rules. It is presumable that these decisions also have had an important effect on the rather reasonable reliabilities that were attained with these observation-instruments.

7.2.2.4 Reliability

On the basis of, among other things, information about reliabilities, the instruments were revised in three try-outs. The final determination of reliability for both the Advance Organizer model and the Role Playing model was based on the data of a random sample of 6 teachers (one teacher from each of the experimental groups, for both primary and secondary teacher education). The agreement between two coders, expressed as Cohen's Kappa, was .83 and .85 for the Advance Organizer model and the Role Playing model respectively. This reliability is considered satisfactory. Besides the detailed set of decisions rules, there has no doubt been a positive effect from the availability of videotapes. Compared to observation in real classroom situations, this is an enormous advantage for the purpose of reliability. It is even doubtful whether it would be possible to employ this type of observation-instrument in real-life classroom situations. In view of the fact that these instruments were explicitly devised for research purposes, this limited usability is not considered problematic.

7.2.3 Results

7.2.3.1 Differences between the experimental groups

The data that will be presented here pertain to the degree to which theory elements can be found in teachers' classroom behaviors, exhibited at their probationary schools. In this section only the behavioral data will be discussed. The relationship between behavior and cognition will be treated in

section 7.3.

Analogous to the stimulated recall part of the investigation, the main research questions refer to the differences between the experimental groups. As with the stimulated recall data, the results reported will be specified for the separate theory elements of both educational theories. The average scores per theory element for the three experimental groups are presented in Table 21 and 22.

Visual inspection of the tables reveals a quite clear tendency between the experimental groups. It appea s that for both the Advance Organizer model and the Role Playing model the TT-group has the highest scores, followed by the T-group, followed by the C-group. With the Advance Organizer model there is one exception: the average C-group score for theory element 1 is higher than the average T-group score. There is also one exception with the Role Playing model: the T- and the C-group obtained the same average scores for theory element 6. It can be stated that at the level of simple visual comparison between the experimental groups, there is a systematic tendency that is violated only in some exceptional cases. If one confines oneself to

Table 21 Mean teacher behavior scores (and standard deviations) per theory element, specified for the three experimental groups (Advance Organizer model).

Theory element	Experimental group					
	TT		T		C	
	M	SD	M	SD	M	SD
1	1.0	0	0.3	0.4	0.6	0.7
2	1.0	0	0.6	0.5	0.1	0.3
3	2.4	1.1	1.0	1.2	0.1	0.3
4	7.0	2.1	6.5	2.1	6.3	3.4
5	6.4	1.6	5.3	2.1	4.0	3.3
6	2.8	1.2	0.9	1.4	0	0
7	5.6	3.0	2.7	2.1	0.2	0.4
8	2.5	1.6	1.5	2.5	0.9	1.7
9	3.3	1.8	2.6	1.8	0.2	0.4
10	4.0	1.6	1.3	1.1	1.0	1.4
11	4.7	2.4	2.3	0.8	1.1	1.1
12	0.8	0.6	0.4	0.7	0	0
Total	41.5	7.8	25.4	5.9	14.5	6.1

Table 22 Mean teacher behavior scores (and standard deviations) per theory element, specified for the three experimental groups (Role Playing model).

Theory element	Experimental group					
	TT		T		C	
	M	SD	M	SD	M	SD
1	6.6	0.8	6.3	2.2	4.2	0.8
2	4.3	1.3	3.2	1.4	1.4	1.3
3	1.8	0.9	1.3	0.9	0.3	0.5
4	6.2	1.2	4.1	1.9	1.1	1.6
5	3.7	1.6	2.0	2.1	0.1	0.3
6	0.8	0.8	0.3	0.7	0.3	0.7
7	3.4	1.1	2.4	1.8	1.5	1.9
8	3.6	2.0	1.1	1.7	0	0
Total	30.4	4.1	20.6	5.5	8.9	3.1

the TT- and the T-group there is not even a single theory element that does not fit into this tendency.
As with the stimulated recall data, the low scores for the C-group are not peculiar. This group did not get any theory-related treatment. One could interpret these scores as an indication of the degree of theory-consistent behavior exhibited by the average teacher. It indicates the overlap between 'produced' theory-consistent (in the sense of this particular theory) teacher behavior and teacher behavior that is normally exhibited.

The mutual differences that occur between the theory elements (within the same experimental group) can, in common with the stimulated recall data, partly be attributed to the character of the indivudual theory elements. For example, the first theory element of the Advance Organizer model ('Clarifying the aim of the lesson') is normally practiced not more than once in a lesson.

The most obvious procedure for analyzing the differences between the experimental groups is analysis of variance. The homogeneity of variances was assessed with Bartlett's tests; it appeared that with the Advance Organizer model the variances were heteroscedastic at 4 of the 12 theory elements; for the Role Playing model this figure is 2 out of 8. For this reason non-parametric testing is preferred. Differences between the three experimental groups were assessed with the Kruskal-Wallis test. The results are presented in Table 23 and 24.

Table 23 Results of the Kruskal-Wallis one-way analysis of variance on the teacher behavior data of the three experimental groups, specified for the 12 theory elements of the Advance Organizer model.

Theory element	n	χ^2	p
1	30	8.9	0.0112 *
2	30	16.0	0.0003 **
3	30	16.5	0.0003 **
4	30	0.5	0.7673
5	30	4.8	0.0887
6	30	16.8	0.0002 **
7	30	19.4	0.0001 **
8	30	6.8	0.0326 *
9	30	16.9	0.0002 **
10	30	15.3	0.0005 **
11	30	15.8	0.0004 **
12	30	10.0	0.0067 **
Total	30	23.2	0.0000 **

Table 24 Results of the Kruskal-Wallis one-way analysis of variance on the teacher behavior data of the three experimental groups, specified for the 8 theory elements of the Role Playing model.

Theory element	n	χ^2	p
1	30	13.8	0.0010 **
2	30	15.0	0.0005 **
3	30	13.1	0.0014 **
4	30	18.7	0.0001 **
5	30	17.3	0.0002 **
6	30	4.0	0.1336
7	30	6.8	0.0326 *
8	30	16.6	0.0002 **
Total	30	23.9	0.0000 **

From this analysis it appears that with almost all theory elements there are significant differences between the experimental groups. For only two theory elements of the Advance Organizer model (no. 4 and 5) and one theory element of the Role Playing model (no. 6) is there no difference that is significant at the 0.05-level. It should be noted that the results would be almost identical if a parametric analysis of variance had been chosen. Not

finding a significant difference between the experimental groups for the theory elements 4 and 5 of the Advance Organizer model ('working from general to specific' and 'illustrating differentiations with appropriate schemes', respectively) could probably be explained by the fact that these activities normally occur in the common lesson of every teacher (cf. Table 21). This makes it hard to establish differences between trained and untrained teachers. As to theory element 6 of the Role Playing model ('concentrating on personal and societal consequences of the actions and solutions chosen'), the activity is generally, in all conditions, very infrequently employed (cf. Table 22), probably indicating that this activity is so unusual that even trained teachers can hardly bring themselves to actual utilizing it. Also in that case differences between experimental groups cannot be expected.
Apart from the considerations about these three theory elements, it can be concluded that in general there are statistically significant differences between the experimental groups concerning the degree to which the educational theories are employed in classroom behavior.

An impression might be that the overall significant effect is caused mainly by the low level of the Control group. Because finding very low scores with the Control group is not surprising in view of the fact that this group got no special treatment, it is much more interesting to compare the TT- and the T-group. Here the surplus value of the video treatment, compared to the treatment in which only theoretical verbal materials were presented, is the main issue. The differences between these two groups was tested with the Mann-Whitney U-test. The results for the Advance Organizer model and the Role Playing model are presented in Table 25 and 26 respectively.
When the analysis is confined to the TT- and the T-group, with the Advance Organizer model 7 of the 12 theory elements differ at the 0.05-level, while with the Role Playing model this is the case for 4 of the 8 theory elements. So, as a general conclusion it can be stated that in about half of the cases a statistically significant difference between the TT- and the T-group can be established. This result means, compared to the overall comparison between the three groups in which about 5/6 of the theory elements differed significantly, a substantial reduction in the number of significant differences.
In answering the question what value has to be attached to the differences found between the TT- and the T-group, especially in view of the fact that while making 20 comparisons there will, solely on a chance basis, be some significant differences, the direction of the differences is also relevant. For none of the theory elements, neither with the Advance Organizer nor with the Role Playing model, was a difference in the 'wrong' direction observed. When subsequently it appears that these differences are sta-

Table 25 Means of the TT- and the T-group and results of the Mann-Whitney U-test (Advance Organizer model).

Theory element	M_{TT}	M_T	z	p	
1	1.0	0.3	3.30	0.0014	**
2	1.0	0.6	2.18	0.0293	*
3	2.4	1.0	2.27	0.0232	*
4	7.0	6.5	0.85	0.3954	
5	6.4	5.3	1.38	0.1686	
6	2.8	0.9	2.62	0.0088	**
7	5.6	2.7	2.14	0.0327	*
8	2.5	1.5	1.90	0.0580	
9	3.3	2.6	0.88	0.3781	
10	4.0	1.3	3.30	0.0010	**
11	4.7	2.3	2.67	0.0076	**
12	0.8	0.4	1.51	0.1311	
Total	41.5	25.4	3.59	0.0003	

Table 26 Means of the TT- and the T-group and results of the Mann-Whitney U-test (Role Playing model).

Theory element	M_{TT}	M_T	z	p	
1	6.6	6.3	0.74	0.4613	
2	4.3	3.2	1.99	0.0467	*
3	1.8	1.3	1.09	0.2747	
4	6.2	4.1	2.51	0.0121	*
5	3.7	2.0	1.96	0.0495	*
6	0.8	0.3	1.64	0.1010	
7	3.4	2.4	1.29	0.1952	
8	3.6	1.1	2.57	0.0100	**
Total	30.4	20.6	3.25	0.0011	

tistically significant, it is not likely that these differences occurred on the basis of chance. It is more likely that the number of theory elements for which significant differences between the experimental groups can be determined will be related to the size of the sample. Because in this study the labor-intensive investigation procedures did not allow large sample sizes (cf. section 6.2), this is a more obvious explanation for finding significant differences in no more than half of the cases. Apart from that, finding significant differences between the two groups in half of the cases

(while all other differences are in the 'right' direction) is far from trivial. All the more because the main focus of the treatment was not influencing teacher behavior but teacher cognitions (cf. section 7.1).

In section 7.1.4.1 the critical remarks that can be made on the counting procedure were discussed with regard to the analysis of the stimulated recall data. Analogous remarks can be made with regard to the teacher behavior data. Also here observing more instances of theory-consistent behavior indicates a more thorough 'use' of that theory. However, it remains somewhat arbitrary to attach two times as much importance to 10 instances compared to 5 instances, even if the corrections discussed in section 7.2.2.3 are applied. One could argue that the difference between employing a theory element at least one time and employing it not at all is more important than the exact number of times the theory element is employed. Employing the theory element at least once indicates that one is able to use it.
So it should be established how many of the 12 (Advance Organizer model) or 8 (Role Playing model) theory elements every teacher exhibits at least once in his or her lesson behavior. The main research question pertains to the differences between the experimental groups in this respect. These data are presented in Table 27 and 28.
The Kruskal-Wallis analysis of variance reveals that these differences between the experimental groups are statistically significant at the 0.0001-level, both for the Advance Organizer model ($\chi^2 = 22.9$) and the Role Playing model ($\chi^2 = 25.7$). The general conclusion is that the treatment not only influences the degree to which theory elements occur in teaching behavior, but also the degree to which teachers differ with respect to being 'non user' or 'user' (i.e., employing the theory at least once) of that theory.

Table 27 Average number of theory elements that occur at least once in teaching behavior, specified for the three experimental groups (Advance Organizer model).

Experimental group	n	M	SA	95% confidence interval for mean
TT	10	11.6	0.52	11.2 to 11.9
T	10	8.1	1.85	6.8 to 9.4
C	10	4.2	1.87	2.9 to 5.5

Table 28 Average number of theory elements that occur at least once in teaching behavior, specified for the three experimental groups (Role Playing model).

Experimental group	n	M	SA	95% confidence interval for mean
TT	10	7.5	0.53	7.1 to 7.9
T	10	5.9	0.58	5.5 to 6.3
C	10	3.3	1.16	2.5 to 4.1

An interesting question concerns the interaction between type of educational theory and type of treatment. It is conceivable that a particular type of treatment might be especially effective with a particular type of educational theory. For example, in studying a relatively more abstract theory like the Advance Organizer model, one might take relatively more advantage of the video treatment, resulting in relatively higher teacher behavior scores on this combination. From a first inspection of the means per theory per type of treatment it does not seem likely that there is such an interaction (cf Table 29).

Table 29 Average total teacher behavior scores for each type of treatment for the two educational theories.

	TT-group	T-group	C-group	Total
Advance Organizer model	41.5	25.4	14.5	27.1
Role Playing model	30.4	20.6	8.9	20.0
Total	36.0	23.0	11.7	23.6

The exact interaction effect was determined by analysis of variance on these data. The results are presented in Table 30.

Table 30 Results of the ANOVA. Effects of type of treatment and type of educational theory on teacher behavior scores.

	df	MS	F	p
Main effects	3	2220.0	70.14	0.000
Type of ed. theory	1	770.4	24.34	0.000
Experimental group	2	2944.9	93.04	0.000
2-way interactions				
type of theory x exp. group	2	58.8	1.86	0.170
Explained	5	1355.6	42.8	0.000
Residual	54	31.7		

As appears from this table there is a weak, non-significant, interaction. Therefore it cannot be concluded that the types of treatment have a differential effect with the two educational theories.
As to the main effects in Table 30, it should be noticed that the significance of the 'type of educational theory'-effect has no meaning. The two instruments for measuring teacher behavior in the Advance Organizer and in the Role Playing lesson were developed independently. A score on the Advance Organizer instrument is not equivalent to the same score on the Role Playing instrument; the score is highly dependent on a number of choices that have been made within each of the separate models, of which the number of theory elements selected (12 and 8 for the Advance Organizer and the Role Playing model respectively) is the most important one. Comparison of scores only makes sense within the same model. Including the scores on both theories in the same analysis is done for the present case only to determine the interaction effect.

7.2.3.2 Differences between primary and secondary teachers' colleges

The videomaterials were developed for use in both primary and secondary teachers' colleges; try-outs also took place at both types of teachers' colleges. Nevertheless, it is imaginable that, especially because of the differences in context variables in the classroom between schools for primary and for secondary education, employing these educational theories in the classroom can more aptly be done in one type of education than in another. Although in this respect no theoretically founded expectations can be expressed in advance, it might, mainly for practical reasons, be useful to determine whether there are any differences between teachers from

primary and from secondary teachers' colleges in this sense. Half of the teachers in the sample was from primary and half from secondary teachers' college. In Table 31 and 32 the means for the primary and secondary teachers' colleges are given, specified for each of the theory elements.

Table 31 Mean scores for primary and secondary teachers' colleges, specified for the theory elements of the Advance Organizer model.

Theory element	M Secondary	M Primary
1	0.9	0.4
2	0.5	0.7
3	0.9	1.5
4	5.7	7.5
5	5.2	5.3
6	1.3	1.1
7	3.2	2.5
8	1.7	1.5
9	1.4	2.7
10	2.1	2.1
11	2.6	2.7
12	0.4	0.4
Total	25.9	28.8

Table 32 Mean scores for primary and secondary teachers' colleges, specified for the theory elements of the Role Playing model.

Theory element	M Secondary	M Primary
1	5.8	5.6
2	2.9	3.1
3	1.1	1.2
4	4.1	3.5
5	1.5	2.3
6	0.5	0.5
7	2.6	2.3
8	1.6	1.5
Total	19.9	20.0

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It is clear that there are no large differences between the two types of teachers' colleges. It appears that only the difference for theory element 1 of the Advance Organizer model is statistically significant (df = 28 t = 2.50 p = 0.019). Because such a single result could very well occur on the basis of chance, no conclusions can be based on it.
As the lack of differences may have been caused by the generally very low scores of the C-group, a second analysis was done excluding this C-group. The results of this analysis are almost identical to the first one: again just one single significant result can be established (theory element 9 of the Advance Organizer model; df = 17 t = 2.42 p = 0.027). So, also here the primary and secondary teachers' college do not differ in the degree in which theory elements can be determined in teacher behavior.

A final question that can be posed in the comparison between primary and secondary teachers' college concerns the interaction between type of teacher education and type of treatment. It is conceivable that one type of treatment (e.g., the Theory -treatment, focusing on verbal transmittance of information) fits relatively better into the routines of one type of teachers' college, which might result in relatively higher scores on the observation instrument. The average total scores for both types of teacher education, specified for the two educational theories, are presented in Table 33.

Table 33 Comparison between the average total scores of primary and secondary teachers' colleges for each of the three experimental groups, specified for the two educational theories.

	Advance Organizer model		Role Playing model	
	Secondary	Primary	Secondary	Primary
TT-group	37.6	45.4	29.2	31.6
T-group	27.2	23.6	21.8	19.4
C-group	13.0	16.0	8.8	9.0

From this table it can be seen that for the Role Playing model there is no interaction, while for the Advance Organizer model there is a slight interaction: here the primary education teachers perform somewhat better in the TT-group and the C-group and the secondary education teachers somewhat better in the T-group. From a two-way analysis of variance it appears, how-

ever, that this interaction is not statistically significant (df = 2 F = 1.989 p = 0.159). From a more detailed analysis at the level of the separate theory element it appears that the slight interaction between type of treatment and type of teacher education is mainly caused by two theory elements that each have a significant interaction at these variables: theory element no. 10 (df = 2 F = 4.98 p = 0.016) and theory element no. 12 (df = 2 F = 8.00 p = 0.002). These two interactions do not permit well-founded conclusions; they might have occurred on the basis of chance. So the general conclusion must be that in this study an interaction between type of teacher education and type of treatment has not been established.

7.2.3.3 Sequence-effects

To control for sequence-effects in this investigation, half of the teachers gave the Advance Organizer lesson first and half of them gave the Role Playing lesson first. Although sequence-effects could not have contributed to the differences between the three experimental groups, it remains interesting to determine whether there were any sequence-effects at all. Principally the manifestation of sequence-effects with the teacher behavior data is, compared to the stimulated recall data, somewhat less probable. Stimulated recall amounted to a verbalization procedure that was completely new to the teachers, which made it conceivable that a learning process would take place, resulting in relatively higher scores at the second lesson. Giving lessons at their probationary schools is of course an activity the teachers are familiar with. There is a possibility that in the second lesson the teacher had become slightly more proficient in the specific activity of 'employing' an educational theory in his or her behavior. It was determined whether this had been the case. In Table 34 the average scores for the first and the second lesson are compared, specified for all theory elements of both educational theories.
It appeared that for none of the theory elements is there a difference that is statistically significant at the 0.05-level. Thus, there are no sequence-effects, either positive or negative.

Finally, the possibility of an interaction-effect between lesson number and type of treatment was investigated, analogous to the stimulated recall data. There appeared to be no statistically significant interaction effect, either for the total scores or for the separate theory elements. The general conclusion that there are no sequence effects need not be revised in this sense.

Table 34 Average teacher behavior scores at all theory elements, for 'first given' and 'second given' lessons.

		First	Second
Advance Organizer model			
Theory element	1	0.53	0.73
Theory element	2	0.53	0.60
Theory element	3	1.13	1.20
Theory element	4	6.53	6.67
Theory element	5	5.26	5.20
Theory element	6	1.53	0.93
Theory element	7	2.80	2.87
Theory element	8	1.93	1.33
Theory element	9	2.27	2.80
Theory element	10	1.93	2.27
Theory element	11	2.67	2.73
Theory element	12	0.40	0.40
Total		27.53	26.73
Role Playing model			
Theory element	1	5.73	5.67
Theory element	2	3.33	2.60
Theory element	3	1.27	1.00
Theory element	4	3.73	3.87
Theory element	5	2.20	2.67
Theory element	6	0.47	0.47
Theory element	7	2.73	2.13
Theory element	8	1.73	1.40
Total		21.20	18.73

7.2.3.4 Effects of class size

Class size effects could mainly be caused by logistic or organizational constraints, making it relatively difficult for the teacher to exhibit theory-consistent behavior. It is a well-known fact that in large classes the teacher needs a larger part of his or her time and energy for organizational and classroom management activities. One could expect these constraints to manifest themselves relatively more in teacher behavior data, compared to stimulated recall data. It is conceivable that the teacher who has assimilated an educational theory has at some moment cognitions that are related to that theory, without having the opportunity to exhibit the theory-consistent behavior within the constraints of the classroom. In such a case theory-related cognitions are recorded during

stimulated recall, but during observation no theory-related behavior is detected. As to the differences between the two educational theories, if there are any effects of class size, they will mainly occur during Role Playing lessons. The Advance Organizer model is, after all, devised for transmitting large quantities of information in classroom settings; it could be maintained that in this model, class size is a relatively unimportant variable. The Role Playing model requires at some moments organizational measures that could be a problem with large class sizes.

The 30 classes from the sample were classified into small, medium-sized and large, (cf. Table 35). The criteria for this classification were chosen in

Table 35 Means of the teacher behavior scores for the three class sizes, specified for the theory elements of both educational theories.

Class size	≤ 20	21-27	≥ 28
Advance Organizer model			
Theory element 1	0.55	0.87	0.55
Theory element 2	0.55	0.50	0.64
Theory element 3	0.91	1.00	1.55
Theory element 4	6.64	5.63	7.27
Theory element 5	5.64	4.38	5.45
Theory element 6	1.36	0.75	1.45
Theory element 7	3.00	3.25	2.36
Theory element 8	1.54	1.38	1.91
Theory element 9	1.45	2.13	2.55
Theory element 10	2.36	2.00	1.91
Theory element 11	2.72	2.50	2.82
Theory element 12	0.45	0.38	0.36
Total	27.18	24.75	28.82
Role Playing model			
Theory element 1	6.22	5.64	5.30
Theory element 2	3.22	3.36	2.30
Theory element 3	1.11	1.27	1.00
Theory element 4	3.78	4.45	3.10
Theory element 5	2.33	1.73	1.80
Theory element 6	0.56	0.36	0.50
Theory element 7	3.22	2.36	1.80
Theory element 8	1.56	1.91	1.20
Total	22.00	21.00	17.00

such a way that three equally sized groups resulted. Classes were considered small if the size was less than 21, medium-sized if it contained 21 to 27 pupils and large if there were more than 27 pupils. For the distribution of the sizes over the experimental groups see Table 17.
In Table 35 the average results for the three class sizes are presented, specified for the theory elements of both theories.
It appears that there is in fact a small declining tendency with the Role Playing model, indicating that in large classes it becomes relatively more difficult to exhibit theory-consistent behavior. However, from one-way analysis of variance it appears that neither with the Advance Organizer model nor with the Role Playing model is there a difference between the three experimental groups that is statistically significant at the 0.05 level. So the general conclusion should be that in this study class size had no effect on the degree of exhibiting theory-consistent behavior by the teachers.

7.2.4 Conclusions

Six research questions were posed with respect to the teacher behavior variables (cf. section 6.4). The most important one concerned the differences between the experimental groups with respect to the number of theory elements that could be discerned in the behavior of the teachers. From the results just discussed it appears that for almost all theory elements the three experimental group differ significantly. As to the differences between the TT- and the T-group, these are significant for about half of the theory elements.
Just like with the stimulated recall data, a very important additional result is that the differences between the means of the experimental groups are, almost without exception, in the 'right' direction, the TT-group getting the highest scores, followed by the T-group, followed by the C-group. With respect to the TT- and the T-group this even holds for all differences. This makes it less probable that the significant differences found have occurred on the basis of chance.
Not only research question b1, but also research question b2 can be answered in the positive sense: it appeared that the three experimental groups differed significantly with respect to the proportion of the (12 or 8) theory elements that occurred at least once in the teachers' teaching behavior. There was not any overlap between the 95% confidence intervals for the means.
Compared to the effects of the experimental treatment on teachers' interactive cognitions, the effects on teachers' behaviors appears to be somewhat weaker. Given the fact that our type of treatment in the first place

focuses on changing teachers' cognitions (cf. sections 2.5 and 2.6), this result is not at all surprising.

Interaction between type of treatment and type of educational theory (research question b3) could not be established in this study, meaning that the treatments were not particularly suited to either the Advance Organizer model or the Role Playing model.

The effects of three intervening variables between experimental treatment and teaching behavior were investigated (research questions b4 to b6): the teacher being from either primary or secondary teachers' college, the lesson being either the first or the second one given in the framework of this investigation and the size of the class being either large, medium-sized or small. For none of these variables could significant influences be determined, meaning that the conclusions about the effects of the experimental treatment could be maintained. The effects of possible intervening variables that have to do with teachers' implicit theories will be treated in section 7.4 and section 7.5.3.

7.3 Relationship between teacher interactive thinking and teacher behavior

7.3.1 Introduction

Some theoretical considerations for investigating the relationship between teacher interactive thinking and teacher behavior were treated in section 3.3. This relationship can be studied at several levels, the most global one focusing on the overall correlations between the scores from stimulated recall and the scores from the analysis of the videotapes of the lessons; this is reported in section 7.3.2.
Teachers' estimations of their own use of theory elements in their behavior were correlated with their actual use of these theory elements. These data are reported in section 7.3.3. This also provides some insight into the teachers' awareness of their own teaching behavior at this global level, as far as these theory elements are concerned.
The procedures for comparing cognition and action that are reported in sections 7.3.4 and 7.3.5 are of a much more sophisticated character. The problem with the procedure reported in section 7.3.4 is that it draws heavily on the teacher's ability to imagine retrospectively what the importance of the distinct cognitions has been: directly after stimulated recall the teacher is asked to indicate the relative importance of 30

interactive thoughts that were reported during stimulated recall.
The final procedure (section 7.3.5) is considered the most important one; no additional information is elicited from the teacher here. The procedure consists of a meticulous comparison between separate theory-consistent behaviors that were visible at the videotape and cognitions that were reported during stimulated recall.

7.3.2 Correlation between teacher cognition and teacher behavior

The most obvious and at the same time most superficial way of investigating the relationship between teacher cognition and teacher behavior is to determine the correlation between the stimulated recall scores and the scores that were obtained from the analysis of the videotapes. The rationale for these measures, the instruments that were used and the results that were obtained have been reported in sections 7.1 and 7.2. One would hypothesize that an existing relationship between the type of cognition and action that are under investigation here also manifests itself in the frequency of the theory elements in the stimulated recall protocols and in the teacher behavior, in the sense that a high frequency of a particular theory element would correspond to a relatively high degree of 'employment' of this theory in classroom behavior. Moreover, one would hypothesize that this correspondence would be higher in the TT-group, compared to the T-group. Because of the character of the treatment, the TT-group had a better opportunity to see the theory 'in operation'; it is hypothesized that this will promote the degree to which one is subsequently able to consciously apply the theory in one's own behavior.
Because of the relatively low scores of the C-group, this group is less important in the present comparison. The comparison will mainly focus on the surplus value of the video-treatment, contrasted to the purely theoretical treatment.

The overall correlation between stimulated recall scores and teacher behavior scores is rather high. For the Advance Organizer model this figure ranges from .44 (theory element 5) to .86 (theory element 9), with a total correlation over all theory elements of .68. All correlations are statistically significant at the .05 level. The correlations for the Role Playing model range from .37 (theory element 7) to .83 (theory element 4), with a total correlation over all theory elements of .61. For 5 of the 8 theory elements the correlation is significant at the .05 level here.
Because the three experimental groups were taken together in this analysis, the high correlations are not remarkable. We will focus on the differences between the TT- and the T-group. It appears that in some cases the corre-

lation coefficient is undefined because of the fact that for one of the variables all scores of one of the groups are maximal (theory elements 1 and 2 at the Advance Organizer model, TT-group) or minimal (theory element 6 of the Role Playing model, T-group).
The first comparison between the TT- and the T-group was to determine whether they differed in the number of theory elements that have a significant correlation between stimulated recall score and teacher behavior score. This information is reported in Table 36.

Table 36 Number of theory elements that have a significant correlation ($p < .05$) between stimulated recall score and teacher behavior score, specified for the TT- and the T-group.

	TT-group	T-group
Advance Organizer model (total: 12)	4	3
Role Playing model (total: 8)	1	1

It is clear that on the basis of these data no difference between the TT- and the T-group can be established.

Another way of comparing the TT- and the T-group is by utilizing the average correlation over all theory elements. Negative correlations are left out of consideration here. (Of all correlations from both experimental groups only two are negative: theory element 5 of the Advance Organizer model with the TT-group and theory element 3 of the Role Playing model with the T-group.) The results of this comparison appear in Table 37.

Table 37 Average correlations between stimulated recall scores and teacher behavior scores, specified for the TT- and the T-group.

	TT-group	T-group
Advance Organizer model	.62	.60
Role Playing model	.43	.47

On the basis of the data presented up to now it can be concluded that at the overall level there is a correlation between the stimulated recall

scores and the teacher behavior scores, but that at the level of the distinct experimental groups this correlation is statistically significant in only a minority of the cases (i.e., theory elements), more so in the case of the Role Playing model than the Advance Organizer model (cf. Table 36).
It should be noted that the data in this analysis were of a very global nature: for every theory element the total score on the stimulated recall and on the teacher behavior instruments were used. The conclusion is that at this global level there are no differences between the TT- and the T-group in the degree to which stimulated recall scores and teacher behavior scores correspond.
In the following sections (especially sections 7.3.4 and 7.3.5) more sophisticated procedures for comparing cognition data and action data will be treated.

7.3.3 Teachers' retrospective estimation of their own use of theory elements

A second, also rather global and superficial, investigation into the relationship between cognition and action concerns the question whether the teacher is able to assess retrospectively the degree to which he or she employed the educational theory during teaching. It is important to note that the object of study is not the direct relationship between interactive cognition and teaching behavior. Rather, the teachers' subjective ideas about that relationship are at issue.
It might be expected that those teachers who are able to correctly assess the degree to which they employed the educational theory also employed this educational theory more consciously in their teaching. One of the measures, taken directly after the stimulated recall interview, concerns the following. All 12 or 8 theory elements (of the Advance Organizer model or the Role Playing model respectively, dependent on the type of lesson just given) were examined. Each of the theory elements had a nine-point scale. The teachers were instructed to use the nine-point scale to indicate to what degree each particular theory element was, in their opinion, 'to be seen' in the lesson just given. Of course only those teachers who were familiar with the educational theories and the related theory elements could be asked these questions, i.e., this part of the investigation pertains to the TT- and T-group only.

The teachers' retrospective assessments of their own use of the theory elements were compared to the data from the investigation into teachers' actual use of theory elements during teaching (cf. section 7.2). The correlation between these two figures can be seen as an indicator of the

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insight of the teacher into and awareness of his or her own teaching behavior, as far as these educational theories are concerned. The assessments are rather global: particular teacher behaviors or particular lesson episodes are nowhere taken into consideration. The question concerns 'employment of theory element X' in the lesson as a whole. Of course it can be challenged whether the teacher, confronted with such a global task, will be able to sufficiently reconstruct the details of the lesson that are relevant for answering the question, all the more so because 12 or 8 theory elements have to be completed in sequence.
It was expected that, because of the more adequate treatment-related introduction to the practical implications of the theory, the teachers of the TT-group would be relatively more able to assess correctly the degree to which they employed the educational theories in their teaching behavior. The line of reasoning is analogous to the one discussed in section 7.3.2.

Table 38 Correlation between teachers' estimate of their own use of theory elements during the lesson and their actual use of those theory elements.

Advance Organizer model		Role Playing model	
Theory element	Correlation	Theory element	Correlation
1	.14	1	-.01
2	.29	2	.07
3	.24	3	-.19
4	.37	4	.64 *
5	.18	5	.37
6	.39	6	.59 *
7	.51	7	.13
8	.16	8	.18
9	.36		
10	.23		
11	.10		
12	.37		

(* = significant at .05 level)

In the first place the overall relationship between the teachers' estimation of their own use of educational theory and their actual use of that theory is taken into consideration. It appeared that the correlation between the total scores (i.e., the correlation between the total use of all theory elements and the average estimate of their own use, being the mean of the 12 or the 8 nine-point-scales) was the same for the Advance Organizer model and the Role Playing model: .21 and .22 respectively. The correlations for the separate theory elements are given in Table 38.

There are with the Role Playing model not only some rather high (significant) correlations, but also negative correlations, resulting in an average correlation that equals the average of the Advance Organizer model. It must be concluded from these data that the correlation between the teachers' estimate of their own use and actual use is very low; of course no conclusions can be based on some single significant correlations at the level of the separate theory elements.

It is possible that the results for the separate experimental groups would differ from the overall picture as reported above. This, however, appeared not to be the case, making it pointless to test the differences between the experimental groups in this respect. Some summary statistics for the TT and the T-group are reported in Table 39.

Table 39 Some summary statistics concerning the correlation between teachers' estimates of their own use of educational theory and actual use, specified for the TT-and the T-group.

	Correlation between total scores	No. of significant correlations
Advance Organizer model		
TT-group	.09	0
T-group	-.09	0
Role Playing model		
TT-group	.02	1
T-group	.28	0

The general conclusion must be that not only were there no differences between the experimental groups, but also that teachers generally had a very scanty insight into the degree to which they employed the educational theories in their own classroom behavior. This globally formulated assignment probably set too high a demand on the teachers' ability to remember all kinds of details of the lesson given. In fact, the teacher is asked to recall the whole lesson 'in one go' and subsequently rate that total lesson on one criterion (the degree to which theory element X was employed in it). Directly after that the next assignment is given, etc. In the next two sections (7.3.4 and 7.3.5) much more attention is given to the details of the lessons.

7.3.4 Perceived importance of interactive thoughts for subsequent behavior

7.3.4.1 Introduction

Up to now the relationship between cognition and action has been discussed at a global level. The interdependence between cognition variables and action variables was studied without taking into consideration the separate, particular thoughts and actions that were involved in the lessons under investigation.

In this section a procedure will be presented to interrogate the teachers about their particular cognitions and their teaching behaviors. Although the separate cognitions were at issue here, this procedure still placed great demands on teachers' insight into and ability to report about their own cognitions. This demand was much higher than the demands of the ordinary stimulated recall interview. In the normal stimulated recall interview the teacher is required, on the basis of viewing the videotape of his or her own lesson, to 'relive' the situation and to externalize directly his or her interactive thoughts. In the present procedure the teacher was not only required (on the basis of just a simple stimulus) to have an insight into his or her past interactive cognitions, but also to be able to indicate the importance of those cognitions for subsequent behavior. The hypothesis was that the TT-treatment has induced such a degree of 'awareness' of the educational theory (thereby illustrating and clarifying the relationship between theory and practice) that the teaching behavior of the teachers who got the TT-treatment would be influenced relatively stronger by theory-related cognitions.

Focusing on separate teacher cognitions was facilitated by the fact that statements of interactive teacher cognitions were available from the stimulated recall interview; in the stimulated recall interviews on the average about 115 teacher utterances referred to their cognitions. During the stimulated recall session the teacher utterance was written on a separate card by the investigator every minute (plus or minus 20 seconds), as indicated at the counter of the videotape (cf. section 6.3.3). These teacher utterances were the 'material' to be used in the present procedure. Two restrictions were made in this part of the investigation. Firstly, the total number of teacher utterances was limited to 30. This sample was considered sufficient for obtaining an idea about the importance of theory-related cognitions for teacher behavior; because the teacher utterances must all successively be rated by the teacher (cf section 7.3.4.2), there had to be some limitation on the number of teacher utterances. Secondly, in this procedure the concept 'relationship between cognition and action' was restricted to 'importance of the teacher cognition for teacher behavior in

the classroom'. The teacher was asked to indicate to what degree every separate teacher cognition (as represented in the teacher utterance that was written on a separate card) had influenced subsequent teacher behavior. It is imaginable that other types of relationship between cognition and action may have occurred, e.g., an action triggering a teacher cognition. It was supposed that 'influencing behavior by cognition' was not only the most frequent type of relationship, but also that for the teachers this type of relationship was the most obvious one. The possibility of such a relationship is self-evident for the teacher and does not require extensive (and potentially confusing) explanations in the investigation procedure.
Besides, this type of relationship is also theoretically the most interesting: in line with the theoretical line of reasoning (cf. Chapter 2), the educational theory is supposed to be incorporated into teachers' cognitions in such a way that this leads to teaching behavior that is influenced by the theoretical insights.
Thus, the focus of this part of the investigation is the teachers' own perceptions of the importance of 30 interactive cognitions, importance being understood as 'influencing subsequent classroom behavior'. In line with the main research questions, attention was concentrated on the difference between the perceived importance of theory-related interactive cognitions, compared to interactive cognitions in general. It was expected that the teachers of the TT-and T-group would consider the theory-related cognitions more important than the non-theory-related cognitions, the difference being largest in the TT-group. For the C-group it was expected that the two types of interactive cognitions would be considered equally important.

7.3.4.2 Procedure

The procedure started with the pile of cards containing the literally written teacher utterances that were made on the whole minute (cf section 6.3.4.1). These utterances were looked through with the teacher. If a teacher utterance was not recognized as such, this card was put aside. Also in order to obtain the same number of cards for every teacher, the remaining pile of cards was randomly reduced to 30. Of course this pile of cards contained both theory-related and non-theory-related interactive cognitions.
A prerequisite for drawing valid conclusions from this part of the investigation was that the percentage of theory-related teacher utterances in this pile of 30 cards was the same as in the total collection of teacher utterances, done during the whole stimulated recall interview. As can be

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seen in Table 40, this appeared to be the case. The t-tests reveal that none of the differences are statistically significant.

Table 40 Average percentage of theory-related teacher utterances in the selected 30 cards and in the total number of teacher utterances.

	M_{30}	M_{Total}	df	t	p
Advance Organizer model					
TT-group	42.7	43.8	9	.34	.74
T-group	22.6	23.3	9	.36	.73
C-group	9.6	10.6	9	.70	.50
Total	24.9	25.9	29	.72	.48
Role Playing model					
TT-group	46.6	44.5	9	-.70	.50
T-group	25.4	25.7	9	.16	.88
C-group	10.7	10.6	9	-.09	.93
Total	25.4	25.7	29	.16	.88

The teachers were handed the pile of 30 cards and were asked to Q-sort these cards. They were asked to form 5 piles of 6 cards each, putting the most important cards (i.e., those teacher-cognitions that had the most influence on their subsequent teaching behavior) in the extreme left pile, putting the least important cards in the extreme right pile and putting the remaining cards in piles from left to right to indicate gradually decreasing importance. The instructions to the teacher on this task can be found in section 6.3.4.1. There were no time constraints put on the teacher for completion of the task.
The results were recorded on a scoring form. A card that was put in the extreme left pile was scored 5, etc. In this way every separate teacher-cognition got an unequivocal rating concerning its importance (as defined in section 7.3.4.1) as assessed by the teacher.

7.3.4.3 Results

Because the number of theory-related cognitions (within the 30 cards) was of course different for every teacher and because the three experimental groups also differed systematically in the average number of theory-related cognitions, it was not possible to use the total raw scores. The total raw score for every teacher (i.e., the sum of the scores of the separate theory-related cognitions) was divided by the number of theory-related

cognitions, resulting in an average score which could be considered the teacher's estimation of the 'average' importance of his or her theory-related cognitions. The same was done for the non-theory-related teacher cognitions.
First it was determined whether there was a difference in perceived importance between the theory-related and the non-theory-related cognitions. Paired samples t-tests were used to test the significance of these differences. The results are presented in Table 41.

Table 41 Perceived importance of theory-related and of non-theory-related interactive cognitions for subsequent teacher behavior.

	M_{theory}	$M_{non\text{-}theory}$	df	t	p
Advance Organizer model					
TT-group	3.28	2.72	9	8.57	0.000
T-group	3.33	2.90	9	4.94	0.001
C-group	3.00	3.00	9	0.00	1.000
Total	3.20	2.87	29	4.57	0.000
Role Playing model					
TT-group	3.33	2.63	9	6.78	0.000
T-group	3.30	2.92	9	3.69	0.005
C-group	2.86	3.00	9	-1.45	0.185
Total	3.16	2.85	29	3.67	0.001

It is evident that within the TT- and within the T-group there are significant differences between the two types of teacher cognitions: theory-related teacher cognitions are rated statistically significant more important for subsequent teacher behavior than non-theory-related teacher cognitions. This result is noteworthy, especially because it is very unlikely that during the Q-sort the teachers recognized the theory-related cognitions as such: the teachers sorted a substantial number of their utterances, all referring to the content of their lessons, at a rather fast pace. Besides, during the preceding stimulated recall session the researcher made no allusion to the educational theory or to the pertinent theory elements (cf. section 7.1.2.1).
The results suggest that these teachers considered the theory-related cognitions more important. It is remarkable that this holds for both the TT- and the T-group: for both groups the differences, although unequal in magnitude, are statistically significant. The results for the C-group are consistent with the expectations: for those teachers (who got no theory-relevant treatment) the theory-related cognitions are of the same impor-

tance as the non-theory-related cognitions.
In the next step it was determined whether the three groups differed significantly as to the average scores assigned to the theory-related cognitions. The results of the analysis of variance on the Advance Organizer data are presented in Table 42.

Table 42 Results of the analysis of variance on the differences between the experimental groups on the average Q-sort scores of theory-related cognitions (Advance Organizer model).

	df	MS	F	p
Between groups	2	.3163	3.5337	.0433
Within groups	27	.0895		

Duncan's multiple comparison test was used to determine which differences caused this significant value. It appeared that the significant F-value was the result of the low C-group value. Two subsets were determined, one containing group C and one containing group TT and T. The conclusion must therefore be that the TT-group and the T-group do not differ significantly in this respect: the teachers from both groups value the theory-related cognitions equally high concerning their influence on subsequent teacher behavior. Table 43 contains the same information about the Role Playing model.

Table 43 Results of the analysis of variance on the differences between the experimental groups on the average Q-sort scores of theory-related cognitions (Role Playing model).

	df	MS	F	p
Between groups	2	.6923	12.7597	.0001
Within groups	27	.0543		

Also here, from Duncan's multiple comparison test it appeared that there were only two subsets, one containing the C-group and one containing the TT-group and the T-group. The conclusion here must likewise be that the TT-group and the T-group do not differ significantly.

7.3.4.4 Stability of the Q-sorts

An important indication of the reliability of the Q-sort procedure can be obtained by determining its stability. A complicating factor is the impossibility of taking a second measure after a longer period of time. The cards to be sorted pertain to teacher cognitions from the immediately preceding stimulated recall session. It cannot be expected that the teachers are after, say, one day, able to bring to mind the precise meaning of the interactive cognitions that are written on the cards. For this reason the first Q-sort took place immediately after the stimulated recall session and the second Q-sort 15 to 20 minutes after the first one. It is possible that the short time-span between first and second sorting produced some testing effects; however, there was no alternative to following the procedure chosen.

The most important objective of the second Q-sort was to find out whether during the second sort the cards with the theory-related cognitions were estimated to be of about the same importance as during the first Q-sort. The correlation between the average scores on the first and the second Q-sort was .85 for the Advance Organizer model and .84 for the Role Playing model.

An obvious way of comparing the two Q-sorts is by means of the average scores obtained for the theory-related cognitions. These data are presented in Table 44.

Table 44 Average scores (and standard deviations) of the theory-related cognitions on the first and the second Q-sort.

	First Q-sort		Second Q-sort	
	M	SD	M	SD
Advance Organizer model				
TT-group	3.28	.12	3.34	.16
T-group	3.33	.24	3.29	.28
C-group	3.00	.44	2.90	.41
Total	3.20	.32	3.18	.33
Role Playing model				
TT-group	3.33	.14	3.30	.15
T-group	3.30	.25	3.27	.29
C-group	2.86	.28	2.74	.36
Total	3.16	.31	3.10	.38

The differences between the first and second Q-sort are so small that testing its statistical significance was considered unnecessary.

The figures in Table 44 are averages. In addition, it makes sense to determine the stability of the ratings at the level of the separate teacher cognitions. As indicated in section 7.3.4.2, the teachers had to Q-sort 30 cards, distributing them equally over 5 categories (from 'very important' to 'very unimportant'). It was determined what percentage of the cards in the two Q-sorts were rated identically.
It is conceivable that in a number of cases it was difficult for the teacher to decide whether a particular interactive cognition had to be classified in category X or in the adjacent one; there are no strictly delineated boundaries between the categories. For this reason a second measure was defined, based on the notion that during the second Q-sort the rating may deviate one category from the first one. So, it was determined for what percentage of the cards containing theory-related cognitions the second rating differed more than one category from first one. The results are presented in Table 45.

Table 45 Some comparisons between the first and the second Q-sort of the theory-related interactive cognitions.

	Percentage scored identically	Percentage deviating more than one category
Advance Organizer model		
TT-group	79	2
T-group	84	3
C-group	86	2
Total	83	2
Role Playing model		
TT-group	78	6
T-group	77	0
C-group	69	0
Total	74	2

It can be concluded that in general more than three quarters of the theory-related interactive cognitions were rated identically during the two Q-sorts. The percentage of cognitions that deviated more than one category during the second Q-sort is very small: 2%, being on the average less than 1 of the 30 cards that were used in the Q-sort.
Within the inevitable restrictions described in the beginning of this section, the stability of the Q-sorting is considered satisfactory.

7.3.5 Direct comparison between cognition and behavior

7.3.5.1 Introduction

The methods of investigating the relationship between teacher thinking and teacher behavior that were reported in the preceding sections had some shortcomings. In the first place, either global opinions about this relationship or correlations at the most general level between teacher behavior and teacher cognition were used. In this respect the theory elements of the two theories were used comprehensively, without referring to specific instances of use during this particular lesson (cf. section 7.3.2 and 7.3.3). In the second place, the methods of investigation reported up to now strongly relied on teachers' opinions about the importance of interactive cognitions for subsequent teaching behavior (cf. section 7.3.4). In the latter case the specific cognitions from this particular lesson were involved, but only very simple means were used to elicit teachers' responses: the teachers were confronted with the card on which their utterances were written and they were asked about the importance of that interactive cognition. It could be questioned whether the teachers are, on the basis of this kind of stimulus, able to reconstruct the actual cognition and especially to give information about its importance for subsequent teaching behavior. One could doubt whether it is basically possible to use simple interrogation to obtain information about the relationship between teacher behavior and teacher cognition; it is unclear whether this relationship is sufficiently transparant to the teachers themselves to report about it.

In any case, it is advisable to supplement the methods for investigating the relationship with a more direct means for comparing action and cognition. This method adds up to the following: it is determined whether every theory-consistent behavior that is seen in the lesson (on the videotape) is 'accompanied by' an appropriate teacher cognition (as detected during stimulated recall). It was possible to employ this method of investigation because both theory-consistent behaviors and theory-related cognitions from all lessons had been recorded. This part of the investigation was very labor-intensive, requiring a meticulous comparison between videotape data and stimulated recall data.

The basic research question of this part of the investigation can be worded as follows. The teacher exhibits a certain amount of theory-consistent behavior. To what degree is it possible to determine a counterpart of this behavior in his or her interactive cognitions? A counterpart is defined as 'an interactive cognition, referring to the same theory element and pertaining to the same lesson fragment'. If it is not possible to determine such a counterpart for the teacher's theory-consistent behavior, the reason

could be either that theory-consistent behavior had been exhibited 'by chance' or that this behavior is simply part of the more or less automatized behavior of the 'average' teacher (in the way the theory-related behavior of the Control-group can be considered the behavior of the 'average' teacher). It should be noticed that the absence of a cognitive counterpart can hardly be explained by the fact that the behavior was learned during the training, but since that time is fully automatized, no longer requiring any conscious cognitive activity. There was on the average a one month interval between training and investigation, and besides these student-teachers of course spent only a part of their time on actual teaching. So, it is too far-fetched to explain any absence of cognitive counterparts by routinization of the theory-consistent behaviors on the part of the teacher.

So an assumption is that, for exhibiting the theory-consistent behavior that was learned during training, conscious cognitive activity is required on the part of the teacher. Assuming that the method of stimulated recall is a valid way of depicting teacher cognitions (cf. Chapter 4), these cognitions can be traced in the stimulated recall protocol.

A second assumption concerns the moment at which the cognitive counterpart of the theory-consistent behavior manifests itself. Theoretically it is possible that during some part of the lesson there was a theory-related cognition and that the behavioral counterpart manifested itself at a completely other moment in the lesson. However, it is assumed that normally, even in such a case, elements of those cognitions will also manifest themselves during (or just before or after) the related behavior. The assumption is, in other words, that a cognitive counterpart of the theory-consistent behavior will also manifest itself in the period of time 'around' that behavior. This means that around the moment the theory-consistent behavior occurs, a time interval has to be defined and that it has to be determined whether the appropriate thought, i.e., the counterpart-cognition, occurs in this time interval.

Of course there can be discussion about the magnitude of this time interval. It is clear in advance that if the interval is larger, relatively more teacher behaviors will be found that 'are accompanied by' appropriate interactive cognitions: in large intervals those teacher cognitions that are in time rather far away from a theory-consistent teacher behavior will also be taken as 'accompanying' that behavior. Of course the basic problem here is whether the magnitude of the interval in any way influences the conclusions that will be drawn on the basis of the data obtained. The aim of this investigation is to determine whether there are any differences between the experimental groups, in this case as to the degree to which teacher behaviors are 'accompanied by' appropriate thoughts.

The form that was devised for coding the teacher behavior data (cf. Figure 1 section 7.2.2.3) was also used for coding the relationship between behavior and action. The data that were coded on that form were supplemented with the teacher cognition data of the lesson involved. The result is a representation of the data as depicted in Figure 2.

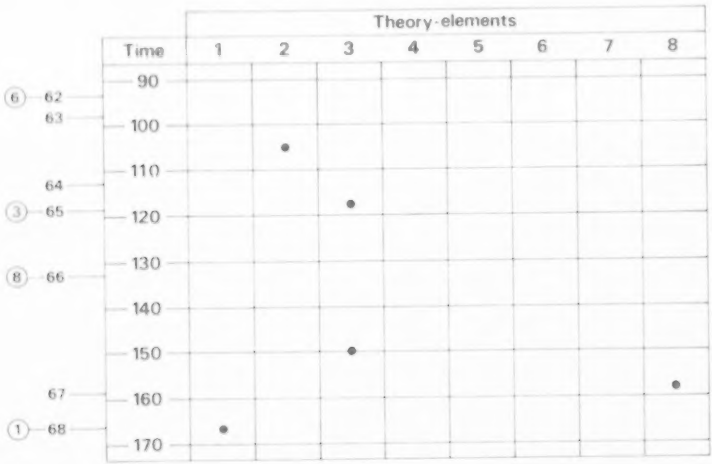

Figure 2 Example of a small part of the coding form for depicting teacher behavior and teacher cognition data simultaneously.

In this figure the two columns in the left margin pertain to the stimulated recall data. The 'time' column divides the lesson into periods of ten seconds. This time column is the starting point for the coding procedure, as discussed in section 7.2.2.3. From Figure 2 it can be seen that during the 94th second of this lesson the teacher in the stimulated recall interview made an utterance, that this utterance (in the consecutive numbering of all teacher utterances) was numbered 62 and that in this teacher utterance there was a reference to theory element 6 (of the Role Playing model). Directly after that (about the 97th second) there was another teacher utterance (numbered 63) that contained no theory-related cognitions, etc. In the middle of the figure (column 3) it can be seen that in the 118th second there was a theory-consistent behavior (pertaining to theory element 3), which was accompanied by an appropriate interactive cognition. The same happened during the 166th second of this lesson (pertaining to theory element 1). During the 159th second a theory-consistent behavior occurred (theory element 8); whether the teacher cognition referred to in the 133rd

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second will be considered an 'accompanying' cognition to this teacher behavior depends on the magnitude of the time interval chosen. If a time interval of 40 seconds (i.e., from 20 seconds before to 20 seconds after the teacher behavior) is chosen, this cognition falls outside the interval. If a 60 second interval is chosen, the cognition lies within it.
All cases were checked to see whether the teacher utterance referred to the same lesson fragment as the teacher behavior. Thus, it cannot happen that a teacher cognition is scored as 'accompanying a teacher behavior' while teacher cognition and teacher behavior refer to different lesson fragments or lesson events.

7.3.5.2 Differences between experimental groups

The most obvious question concerning the direct comparison between action and cognition is whether there are any differences between the experimental groups as to the number of theory-consistent behaviors that are accompanied by appropriate interactive cognitions. Answering this question simply requires counting the number of times a theory-consistent behavior occurs in each lesson and determining how many times during stimulated recall there are theory-related teacher utterances that can be considered accompanying 'appropriate' (i.e., referring to the same theory element and the same lesson fragment) interactive cognitions. To answer the research questions formulated in this section, 'accompanied by' will be defined as 'falling within the one minute interval'. In other words, a cognition is regarded as 'accompanying' a behavior if the cognition is uttered (during stimulated recall) maximally 30 seconds before to 30 seconds after the occurrence of that behavior (on the videotape). It appears that there are large differences in this respect between the experimental groups. Almost without exception the TT-group has the highest scores, followed by the T-group, followed by the C-group. The average total scores of the three experimental groups on the two educational theories are presented in Table 46.

Table 46 Average total number of theory-related teacher behaviors that are accompanied by appropriate interactive cognitions, specified for the three experimental groups.

Experimental group	TT	T	C
Advance Organizer model	23.2	9.6	2.7
Role Playing model	20.7	8.6	1.4

In interpreting these results the following problem exists. It is true that

there are differences between the experimental groups in the number of teacher behaviors that are accompanied by interactive thoughts. However, from previous analyses it is known that there are large differences between the three experimental groups concerning the number of theory-consistent behaviors. If the number of theory-consistent behaviors is already very large during a period of time (say, one lesson), it is obvious that the number of theory-consistent behaviors with some characteristic (in this case, being accompanied by an appropriate interactive thought) will be relatively high too. So, in comparing the three experimental groups, it is preferable to look at the proportions, in other words, which part of all

Table 47 Average proportion of theory-related teacher behaviors that are accompanied by appropriate interactive cognitions, specified for the three experimental groups and all theory elements.

Experimental group		TT	T	C
Advance Organizer model				
Theory element	1	0.80	0.10	0.10
Theory element	2	0.90	0.10	0.00
Theory element	3	0.82	0.35	0.00
Theory element	4	0.46	0.44	0.21
Theory element	5	0.39	0.31	0.03
Theory element	6	0.73	0.15	0.00
Theory element	7	0.49	0.13	0.10
Theory element	8	0.61	0.17	0.00
Theory element	9	0.64	0.51	0.00
Theory element	10	0.45	0.13	0.17
Theory element	11	0.41	0.20	0.10
Theory element	12	0.55	0.15	0.00
Total		0.56	0.37	0.18
Role Playing model				
Theory element	1	0.80	0.57	0.07
Theory element	2	0.71	0.28	0.20
Theory element	3	0.85	0.45	0.00
Theory element	4	0.60	0.52	0.03
Theory element	5	0.59	0.18	0.00
Theory element	6	0.30	0.00	0.00
Theory element	7	0.52	0.23	0.13
Theory element	8	0.76	0.05	0.00
Total		0.68	0.43	0.13

theory-consistent behaviors from a lesson are accompanied by a theory-relevant interactive thought. This eliminates the distortion caused by the

unequal number of theory-consistent behaviors in the experimental groups. The results of this comparison are presented in Table 47.
It appears that there are distinct differences between the three experimental groups. In addition, almost all differences between the experimental groups are in the 'right' direction, the TT-group gaining the highest scores, followed by the T-group, followed by the C-group. An exception is theory element 10 of the Advance Organizer model, the C-group gaining an higher average than the T-group. For theory element 1 of the Advance Organizer model and theory element 6 of the Role Playing model the T- and the C-group score equally high. Concerning the difference between the TT- and the T-group, it holds that the TT-group has a higher score for all theory elements. From the total scores it appears that, generally speaking, the scores of the T-group are two to three times as high as the C-scores, while the TT-group scores one and a half to two times as high as the T-group.

The most obvious procedure for analyzing the differences in proportions found between the experimental groups is by way of analysis of variance. However, it appears (Bartlett's test) that for many theory elements the population variances are unequal. This is the case for 4 out of the 8 theory elements of the Role Playing model. For the sake of comparability of results, all analyses are done nonparametrically.

Table 48 Means of the TT- and the T-group and results of the Mann-Whitney U-test (Advance Organizer model).

Theory element	M_{TT}	M_T	z	p	
1	0.80	0.10	3.07	0.0022	**
2	0.90	0.10	3.48	0.0005	**
3	0.82	0.35	2.45	0.0142	*
4	0.46	0.44	0.23	0.8201	
5	0.39	0.31	0.53	0.5945	
6	0.77	0.15	2.92	0.0035	**
7	0.49	0.13	2.94	0.0033	**
8	0.61	0.17	2.36	0.0183	*
9	0.64	0.51	0.69	0.4878	
10	0.45	0.13	2.46	0.0140	*
11	0.41	0.20	1.75	0.0803	
12	0.55	0.52	1.91	0.0561	
Total	0.55	0.40	0.37	0.0025	**

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Table 49 Means of the TT- and the T-group and results of the Mann-Whitney U-test (Role Playing model).

Theory element	M_{TT}	M_T	z	p	
1	0.80	0.57	2.43	0.0151	*
2	0.71	0.28	2.60	0.0094	**
3	0.85	0.45	1.89	0.0591	
4	0.60	0.52	0.57	0.5694	
5	0.59	0.18	3.20	0.0014	*
6	0.30	0.00	1.83	0.0671	
7	0.52	0.23	1.98	0.0473	*
8	0.76	0.05	3.57	0.0004	**
Total	0.68	0.43	3.37	0.000	**

The differences in proportions between the experimental groups (as presented in Table 47) were tested with the Kruskal-Wallis one-way analysis of variance. It appears that on all theory elements the three experimental groups differ significantly ($p < 0.05$), both for the Advance Organizer model and the Role Playing model. The only exception is theory element 4 of the Advance Organizer model ($\chi^2 = 4.7242$ $p = 0.0942$). In this simultaneous analysis of the differences it is possible that these results are caused mainly by the rather low scores of the Control group. Because apart from this the results of this Control group are theoretically less important, a second analysis was done on the scores of the TT- and the T-group. The results of the Mann-Whitney U-test are presented in Table 48 and 49.
From these analyses it appears that in somewhat more than half of the cases the TT- and the T-group differ significantly. In addition, it should be noted that, as already established, all other (non-significant) differences between these two groups are in the 'right' direction.
If the proportion of teacher behaviors that are accompanied by appropriate interactive thoughts are seen as an indicator of the degree to which employing the educational theories is done consciously and purposely, it may be concluded that this intentional employment of the educational theories is definitely stronger with the TT-group. In other words, not only is the theory employed more fully by the TT-group, this employment is also relatively more sustained by relevant cognitions. One of the goals of our approach especially implies declining types of training that focus on just behavioral changes but instead aims at a greater awareness of one's behavior (an awareness that is informed by educational theory, cf. Chapter 2). It can be concluded that also this goal is reached reasonably well.

7.3.5.3 Effects of time interval

In the previous section the problem of the size of the time-interval was briefly mentioned. The problem is that 'around' every teacher behavior a time interval has to be chosen in order to define which teacher utterances (namely those teacher utterances that fall within the boundaries of this time interval) can potentially be considered appropriate thoughts that 'accompany' that behavior.

That it was necessary to define intervals of some size emerged clearly from the try-outs: The relationship between teacher behavior (as shown on videotape) and teacher thinking (as reported during stimulated recall) took various forms. In some cases the student-teachers, while viewing the videotape, anticipated their behavior ("Here I decided to summarize the main points and..."), resulting in a coding of the interactive thought *before* the behavioral one. In other cases, viewing their behavior on video reminded them of the thought during the behavior in the lesson ("Here I thought..."), resulting in coding of the interactive thoughts element *coinciding with* or *after* the behavioral one.

While it is clear that a time interval has to be chosen in order to define those interactive thoughts that 'accompany' the teacher behavior, the problem is that the size of this interval is in fact arbitrary. There are no decisive reasons why an interactive thought that is uttered 25 seconds after the pertinent behavior should not be considered to 'accompany' that behavior, while an interactive thought that is uttered after 15 seconds should be considered as such.

As already indicated, the data that were used in the previous section to analyze the differences between the TT- and the T-group were based on the one minute interval, i.e., all interactive thoughts that fell within the boundaries from 30 seconds before to 30 seconds after the theory-consistent behavior (and, of course, referred to the same theory element and the same lesson fragment) were considered 'accompanying' appropriate behaviors. A useful procedure for investigating the effects of interval size is experimenting with different time intervals. If with different interval sizes the general conclusions about the research questions remain identical, the arbitrariness of the interval size is of little importance. Because the Control-group scores are rather low on almost all theory elements (which can easily lead to significant overall results) and, besides, the results of this group are theoretically less important, the present analysis, as was the one in the previous section, is focused on the TT- and the T-group. Also here the differences between the TT- and the T-group were tested with the Mann-Whitney U-test. All analyses were done on three sets of data, which were obtained by using three different time intervals: a 40 second interval, a one minute interval and a two minute interval. Table 50

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indicates on how many of the 12 (Advance Organizer model) or 8 (Role Playing model) theory elements the TT- and the T-group differed significantly ($p < 0.05$).

Table 50 Number of theory elements on which the TT- and T-group differed significantly in proportion of teacher behaviors 'accompanied by' appropriate thoughts, specified for various time intervals.

	Advance Organizer model (total = 12)	Role Playing model (total = 8)
time interval		
40 seconds	5	4
60 seconds	7	5
120 seconds	9	5

From this table it can be seen that when the time interval is made larger, there is an increase in the number of theory elements on which the TT-group differs from the T-group. Given the fact that there are systematic differences between these two groups (the TT-group gaining systematically higher scores than the T-group), this fact is not at all remarkable. Knowing that in the same period of time (say, ten minutes) there is a greater proportion of behaviors within the TT-group that are accompanied by appropriate cognitions, it may be expected that if this period of time increases, the difference between these two groups will manifest itself more clearly. This means that if the interval size is increased, there will be more theory elements on which the two TT-and the T-group differ significantly. So the conclusion is that it is true that the interval size is related to the degree with which significant differences between the two experimental groups can be found, but that for this phenomenon there is an explanation analogous to the 'increased sample' effect: if there is a clear tendency, a significant effect can more easily be established by increasing the number of observations.

An alternative way of analyzing the effect of increasing the time-interval on the data obtained concerns the ratio between the experimental groups. It is clear that by increasing the interval, the proportion of teacher behaviors that are accompanied by an appropriate thought increases and that this is the case for both the TT-group and the T-group. However, a very essential question is whether this will change anything in the ratio between the two experimental groups. For example, if for theory element 1 of the Advance Organizer model the average score of the TT-group is 8 times

Table 51 Ratio between TT- and T-scores (proportion of behaviors 'accompanied by' appropriate interactive thoughts) on the theory elements of the Advance Organizer model, specified for three time intervals.

	40 sec. int.			60 sec. int.			120 sec. int.		
Theor-elem.	TT	T	Ratio	TT	T	Ratio	TT	T	Ratio
1	.80	.10	8	.80	.10	8	.80	.10	8
2	.90	.10	9	.90	.10	9	.90	.20	4.5
3	.55	.32	1.7	.82	.35	2.3	.90	.35	2.6
4	.41	.36	1.1	.46	.44	1	.56	.55	1
5	.36	.28	1.3	.39	.31	1.3	.52	.42	1.2
6	.63	.10	6.3	.73	.15	4.9	.76	.15	5.1
7	.44	.10	4.4	.49	.13	3.8	.54	.18	3
8	.53	.13	4.1	.61	.17	3.6	.81	.17	4.8
9	.60	.51	1.2	.64	.51	1.3	.64	.57	1.1
10	.39	.13	3	.45	.13	3.5	.69	.18	3.8
11	.35	.17	2.1	.41	.20	2.1	.54	.20	2.7
12	.35	.10	3.5	.55	.15	3.7	.60	.15	4
Total	.48	.32	1.5	.56	.37	1.5	.66	.43	1.5

Table 52 Ratio between TT- and T-scores (proportion of behaviors 'accompanied by' appropriate interactive thoughts) on the theory elements of the Role Playing model, specified for three time intervals.

	40 sec. int.			60 sec. int.			120 sec. in.		
Theor-elem.	TT	T	Ratio	TT	T	Ratio	TT	T	Ratio
1	.67	.48	1.4	.80	.57	1.4	.88	.69	1.3
2	.50	.20	2.5	.71	.28	2.5	.79	.44	1.8
3	.85	.40	2.1	.85	.45	1.9	.85	.45	1.0
4	.58	.45	1.3	.60	.52	1.2	.84	.74	1.1
5	.64	.08	8	.64	.08	8	.70	.08	8.7
6	.30	.00		.30	.00		.30	.00	
7	.43	.23	1.9	.52	.23	2.3	.58	.23	2.5
8	.70	.05	14	.76	.05	15.2	.81	.05	16.2
Total	.59	.36	1.6	.68	.43	1.6	.78	.52	1.5

the average score of the T-group (cf. Table 47), the question is whether increasing the size of the interval will change anything. In order to investigate whether this is the case, the ratio between the TT- and the T-group must be determined for every theory element and subsequently it must be examined whether this ratio changes as the size of the interval is altered. The relevant results are presented in Tables 51 and 52.
It appears that with the various interval sizes in almost all cases the ratios between the TT-group and the T-group change only very slightly. The total scores in particular are remarkably stable. From the total scores in Tables 51 and 52 it turns out that the average score of the TT-group is about one and a half times the average score of the T-group. This is the case for both the Advance Organizer model and the Role Playing model.
So, when not the magnitude of the proportions of the two groups (and the number of significant differences that is based on that, cf. Table 50) is taken into consideration, but the ratio of the scores of the two groups ("how much better is the TT-group than the T-group"), it turns out that the size of the time interval does not make any difference. Because the differences that emerge from Table 50 are in any case related to the effect of the larger sample size, the final conclusion that is drawn here must be that the size of the interval is unimportant with regard to the conclusions about the main research question. The statements made at the end of the previous section do not need any adjustment on the basis of what is now known about the effects of interval size.

7.3.6 Conclusions

The research questions that were posed with respect to the relationship between cognition and action (cf. section 6.4) fall into three groups: questions pertaining to the global measures of this relationship (questions c1 and c2), questions pertaining to the teachers' perceived importance of their interactive thoughts for subsequent behavior (questions c3 to c5) and questions pertaining to the direct comparison between cognition and action at the level of separate behaviors and cognitions (questions c6 and c7).

As to the first two questions, they can, on the basis of the data just reported, be answered in a straightforward way: at this global level no differences between the experimental groups can be discerned, neither concerning the correlations between stimulated recall data and teacher behavior data (c1), nor concerning the correlations between the teachers' estimations of their own use of educational theory and their actual use of that theory (c2). From the latter result it at the same time appeared that the teachers' awareness of their own use of these theory elements in their behavior is, at this global level, extremely deficient.

It appeared that the procedure employed for investigating the teachers' perceived importance of interactive thoughts for subsequent behavior satisfied the requirements we had set. In the sample of 30 cards on which interactive teacher utterances had been written during stimulated recall, the proportion of theory-related interactive thoughts did not differ from the proportion of theory-related interactive thoughts in all teacher utterances (research question c3). Moreover, the Q-sort procedure for obtaining these data proved to be sufficiently stable (research question c5). From a first analysis, the differences between the experimental groups with respect to the relative importance of theory-related interactive thoughts appeared to be statistically significant, in the sense that the difference was the greatest for the TT-group, followed by the T-group, followed by the C-group. However, it turned out that this overall significance mainly resulted from the low C-group scores. This means that research question c4 must be answered as follows: the three experimental groups differ with respect to the relative importance attached to the theory-related interactive cognitions, but the most interesting difference, the one between the TT- and the T-group, is not statistically significant.

The most detailed comparison between teachers' interactive thinking and teacher behavior concerned a direct comparison of distinct behaviors and cognitions. It was determined what proportion of the theory-related teaching behaviors were accompanied by 'appropriate' interactive thoughts. It appeared that almost all differences between the experimental groups were in the 'right' direction, the proportion of theory-related behaviors with appropriate cognitions being highest in the TT-group, followed by the T-group, followed by the C-group. Confined to the TT- and the T-group it even holds that all differences are in the 'right' direction.
The differences between the three experimental groups were significant for all theory elements. Confined to the most important difference, the one between the TT- and the T-group, it appeared that these differences were significant in about half of the cases. This answers research question c6.
As to research question c7, pertaining to the effect of the time interval around the teaching behavior under investigation, it emerged that increasing the time interval to some degree led to an increase in the number of significant differences between the TT- and the T-group (which could be interpreted as an effect of increasing the 'sample size'), but that the ratio between the TT- and the T-group scores were not affected by the size of the time interval.

As a general conclusion in can be stated, that using the procedures for investigating the relationship between cognition and action at the global level, no such relationship can be determined, while this appears to be

possible when attention is focused on separate behaviors and cognitions. It might be that in the procedures discussed in sections 7.3.2 to 7.3.4 either too much specific information is lost (sections 7.3.2 and 7.3.3) or they draw too heavily on the teachers' ability to retrieve information without appropriate cues for doing so (sections 7.3.3 and 7.3.4).
Because the procedure described in section 7.3.5 is the most detailed and is entirely based on existing data from stimulated recall and videotapes of the lessons, this procedure is considered the most useful and solid. It is, therefore, concluded that there is a relationship between behavior and cognition, which is the most clearly discernable in the TT-group. This indicates that in this group the use of educational theory is relatively most sustained by relevant cognitions.

7.4 Teachers' appraisal of educational theory

7.4.1 Introduction

The main research questions of this study pertain to the role two well-defined educational theories can play in teacher cognition and teacher behavior, and especially the way this can be modified during teacher education. The present chapter pertains to the way in which instruction in educational theory in the more general sense is perceived by the teachers. This is of interest for several reasons. In the first place, it is meaningful to delineate the broader context of our object of study. Information about the way in which instruction in educational theories in general is perceived might be useful for deciding how to structure and present instruction in these educational theories. In the second place, teachers' appraisal of educational theory in the more general sense can possibly explain part of the variance that occurred in dependent variables in the main study. It is conceivable that those teachers whose evaluation of educational theories is relatively high, consider them interesting, etc., will also learn more from the two educational theories in this study and will be more apt to use these theories in their own cognitions and actions.

The educational theory that is at issue here concerns all matters of theory taught in teachers' college apart from subject matter content like history, arithmetics, etc. So it concerns matters of didactics, educational psychology, developmental psychology, methods courses, classroom management, educational evaluation, and so on. In section 7.4.2.1 (Table 53) the

specific components of the educational theory program for the two teachers' colleges from the main study are listed. Special attention will be paid to components pertaining to methods courses; methods courses are related to the content of the treatment in our study. In fact, the two educational theories under investigation can be conceived of as the basis for two teaching methods: classroom presentations of large amounts of information and role playing.

With respect to the teachers' appraisal of educational theory, there is special interest for the perceived usefulness of educational theory for classroom practice. After all, the two educational theories that are at issue in our study are meant to be functional for everyday classroom practice; detailed instructions for classroom application are given and the Theory & Tape treatment is even based on the possibility of recognizing the theory in classroom behavior. In terms of the usefulness of educational theory for classroom application, a distinction can be made between usefulness in probationary school teaching and usefulness in prospective professional work. It can be expected that this perceived 'usefulness for teaching' is not an isolated aspect of educational theory, but will instead be related to other aspects of appreciation such as degree of difficulty, degree of vagueness, etc. An attempt was made in the present part of the study to depict this overall pattern of 'appreciation of educational theory'.
Teachers' appraisal of educational theory, specified for a great number of aspects of appraisal, is reported in section 7.4.3.3.1. Section 7.4.3.3.2 discusses the degree t, which appraisal of educational theory can function as a rival explanation for experimental effects. In the final results-section (7.4.3.3.3) the total pattern of appreciation-aspects is depicted, and the place of a number of separate theory components within this total pattern is discussed briefly.

The whole set of appreciations, related to a number of components of the educational theory program that is developed by the teacher during teacher education is conceived of as an 'implicit theory' of the teacher. The expression 'implicit theory' is used here to denote a set of related ideas about a specific domain (the educational theory program in teacher education) which is normally not articulated or verbalized by the teacher and for which it holds that the teacher is only partly aware of it. From various experiences during training in educational theory, from discussions with fellow-students, from experiences in the probationary school and from their own evaluations of the usefulness of educational theory, a certain image of the value of educational theory emerges. It can be expected that this appraisal will not be identical for all components of educational

theory, all the more because the concept 'appraisal of educational theory' itself can be subdivided into several aspects. Recent research on teachers' implicit theories was discussed extensively in section 3.2.2. In answering the question which investigation procedure is best suited for our purpose it should be noticed that it seems possible in advance to subdivide both the concept 'appraisal of educational theory' itself and the object of appraisal (i.e., the educational theory taught at teachers' college). The Repertory Grid technique seemed to be an appropriate technique for this present condition. Fransella and Bannister (1977) have designated this technique as "a way of exploring the structure and content of implicit theories". Originally this technique was developed within Kelly's 'personal construct theory' and served to investigate role relationships between persons and their families, friends, etc., and for assessing the relationships between a patient's constructs about people. In Kelly's view, a personal construct system is a network of meanings through which a person handles a particular universe of situations. An essential characteristic is that personal construct systems are seen as being made up of sets of bipolar constructs (like intelligent-unintelligent, honest-dishonest, tolerant-prejudiced). All elements of a particular universe (e.g., a group of acquaintances) can be 'assessed' on each of the dimensions.

Although the Repgrid technique was originally developed to investigate people's ideas about other people, there is no theoretical reason why the elements of grids should not include other entities (cf. Pope and Keen, 1981). In the present study the elements for the Repgrid are given by the educational theory program that was taught to the teachers (cf. section 7.4.2.1). In the original application the Repgrid technique was mainly used in clinical settings and, as a consequence, much attention was paid to a careful elicitation of the constructs that were used: only those constructs that were presented by the person under investigation could meaningfully be used to reconstruct his or her personal theory about a particular domain. However, if information about a group of persons is strived for, this procedure leads to severe problems of interpretation, because the resulting grids are not directly comparable. For this reason in the present investigation a set of constructs was developed that could be used with all participants (cf. section 7.4.2.2). It will be clear that in the present study the Repgrid is mainly employed as a technique for eliciting the constructs, which subsequently made it possible to develop the instruments for appraising the educational theory program. Because in the final instruments both elements and constructs were 'fixed', we do not consider our line of research to be in the classical personal construct 'tradition'.

7.4.2 Determining the repertory grids

7.4.2.1 Elements: the teacher education program

The first step in determining the Repgrids was the phrasing of the elements: the entities that are to be commented on. In the present case the universe 'educational theory taught during teacher education' must be subdivided into a number of meaningful components that the teachers may subsequently comment upon. An important advantage over most other studies on teachers' opinions about educational theory (e.g., Oehlschläger, 1978) is that it was not necessary for us to work with global indications (like 'developmental psychology') whose meaning may differ from one teacher to another, but instead could specify the components in such a way that every teacher knew what part of the teacher education program was being referred to. For that reason many of the labels of the components were supplemented by indications that could help the teacher recall the particular part of the training program (e.g., 'developmental psychology of adolescence, Chapters 10 to 15 of book Y').

The components of the teacher education program were formulated by teacher educators from the two teachers' colleges that had participated in the main study (teachers' college for primary education in Sittard and teachers' college for secondary education in Tilburg); this was done by those teacher educators who were responsible for the educational theory program. We started with the teachers college for secondary education. The teacher educator was asked to subdivide the educational theory program into a number of meaningful parts that could be easily recognized by the teachers and were comparable as to the amount of attention paid to them in the curriculum.

There is no consensus in the literature about the optimal number of elements to use in the Repgrid technique. Bonarius (1980) says that originally Kelly used from 15 to 24 elements. According to Pope & Keen (1981), normally a useful basis is provided by between 8 and 15 elements. In the present study it was initially left to the teacher educator how many elements to choose. This appeared to be 21 elements and it was decided to work with this number. The next step was presenting these elements to four teachers (not participating in the main study) and asking them whether they could unequivocally determine to which part in the educational theory program each element referred. This step led to some minor improvements in the phrasing of the elements.

Exactly the same procedure was followed with the teacher educator from the primary teachers' college. For the sake of comparability, this teacher educator was asked to likewise subdivide the educational theory program

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into 21 elements. Table 53 presents the theory-elements as they were phrased by the teacher educators, if necessary adapted on the basis of the teachers' commentaries. References to the relevant books or readers are left out of this table.

Table 53 Educational theory components of the two teachers' colleges from the main study

Primary (Sittard)	Secondary (Tilburg)
1. Children with learning problems or behavioral problems	1. Mixed-ability learning
2. Mixed-ability teaching	2. Innovators like Montessori, etc.
3. School curriculum development	3. The class as a group (leadership etc.)
4. Teaching methods in the questioning mode	4. Function and purpose of education in general
5. 'Alternative' schools (Montessori etc.)	5. Teaching methods for introduction
6. Governmental educational policy	6. The Dutch school system
7. The role of school in society	7. School as a subculture in society
8. Psychology of adolescence	8. Developmental psychology of the age 0 to 12
9. Developmental psychology of primary school age	9. Theory of curriculum development
10. History of education and pedagogics	10. Teaching methods for acquiring and elaborating subject matter
11. The concept of 'adulthood' (in the framework of developmental psychology)	11. Cognitive psychology and attribution theory
12. Learning in school	12. The concepts of communication and group-communication
13. Classroom climate	13. Philosophy of life and education
14. Innovations in the school system	14. Teaching methods for concluding a lesson
15. Test construction	15. Innovations in the school system
16. The development of the child	16. Developmental psychology of adolescence
17. Teaching methods in the soliciting mode (working in groups, etc)	17. Education and the reproduction of social class differences
18. Specifying instructional goals	18. Skill and attitude in communication
19. Educational psychology	19. Developmental psychology of early adulthood
20. Communication	20. History of Dutch education
21. Detecting learning problems on the the basis of error analysis	21. Choosing and assessing curriculum materials

This part of the investigation focused on obtaining information about the way in which the 'average' teacher of each of the teachers' colleges concerned appraised the educational theory program. It should be noted that

these elements were phrased to obtain rather global indications of teachers' appraisal of components of educational theory taught to them in teacher education. Particularly making comparisons between the teachers' colleges should be done very carefully. Indeed there is substantial overlap in the elements of the two teachers' colleges. However, it is clear that the meaning of the labels is not identical in the two colleges. This made it necessary to perform two separate analyses. At the global level some comparisons between the teachers' colleges might be meaningful, but the major part of the attention was directed at the data from the separate teachers' colleges. Special attention was given to the relationship between the appraisal of educational theory and stimulated recall or teaching behavior data. A final major point of attention was the structure in the appraisal data (cf. section 7.4.1).

The requirement found in the literature that the set of elements should be a representative sample from the pool which they are drawn from (e.g., Fransella & Bannister, 1977) was not at issue here: the 21 elements were supposed to cover the domain fully. There were also no difficulties with respect to the requirement that the elements should fall within the range of convenience for the participating subjects (meaning that the constructs principally bear on the elements). The universe of elements is of such a homogeneous character that all kinds of 'appraisal' constructs could easily be applied to them by teachers who completed the program.

7.4.2.2 Constructs: teachers' opinions

In the original applications of the Repgrid technique a separate Repgrid was constructed for every individual (cf. section 7.4.1). Particularly for the constructs it was considered essential that they emerged completely from the individual whose implicit theory about a certain domain was to be investigated. Because we were interested in the implicit theory of the 'average' teacher, the comparability of the separate Repgrids was a problem. By working not only with fixed elements (i.e., the components of the educational theory program, which are identical for every teacher of the same teachers' college), but also with fixed constructs, this problem could be solved. In the literature there are reports of investigations with 'provided constructs'. Fransella & Bannister (1977) remark that, for example, in 'educational fields' working with provided constructs may be an appropriate method. This is especially the case if the information will not be used for the sake of individuals. According to Bonarius (1980), "eliciting personal constructs for research that is not fed back to individual persons is of little use. After all the method for eliciting personal

constructs is rather complex, time consuming and expensive".
A prerequisite for working with provided constructs is that the constructs be meaningful for all persons that are confronted with the standard grid. On the basis of "discussions" with the type of people to whom the standard grid will be provided, the researcher should, according to Pope & Keen (1981), take care "that the nature of the provided constructs is in line with the sort of dimensions which would, in the main, be used by them when considering the elements chosen". For our case it was necessary to unfold the concept "teachers' appraisal of educational theory" into a number of constructs that could be used by the teachers in a meaningful way to characterize the educational theory program in teachers' college. In order to determine the constructs to be included in the standard Repgrids, an elicitation procedure was carried out with 12 teachers, 6 from the primary teachers' college and 6 from the secondary teachers' college. The teachers were neither involved in the main study nor in the screening of the elements of the educational theory program described in section 7.4.2.1. The elicitation procedure that was followed resembles the 'Minimum Context Card Form' that is specified in, for example, Fransella & Bannister (1977). The 21 elements from the educational theory program were written on separate cards. Each teacher got the following instructions: "With this method I should like to learn what your opinion is about the educational theory you were taught at the teachers' college in the past years. The total educational theory program has been subdivided into 21 separate parts that are written on these 21 cards. We will start with the following 3 cards [here 3 cards were put in front of the teacher]. Can you specify some important way in which two of them are alike and thereby different from the third?". Asking for the contrast pole ("In what way does the third card differ from the other two ?") was considered artificial and trivial: the contrast pole was self-evident for all constructs that were provided by the teachers (cf. Table 54). As to the number of triads that were put in front of the teacher, it was clear that not all possible combinations (totalling 1330) could be used. For every teacher 30 triads were selected at random; because the goal was generating a number of meaningful constructs, and not making comparisons between the teachers, a new set of triads was chosen for every teacher.
There are no generally accepted rules for the number of constructs required for a Repgrid. It appeared that selecting those constructs (or their contrast poles) that were mentioned at least once by at least four of the teachers resulted in 15 constructs for the standard grid. These 15 constructs were considered to provide an adequate basis for all teachers to describe their own appraisal of the educational theory program. The 15 constructs (and their contrast poles) that were selected on the basis of this criterion are presented in Table 54.

Table 54 Constructs (and their contrast poles) selected for the standard grid.

1. It is difficult	It is easy
2. It helps you understand better how society is organized	It does not help you to understand better how society is organized
3. It is useful for probationary school teaching	It is not useful for probationary school teaching
4. It has much to do with yourself	It has little to do with yourself
5. I knew most of it already	Most of it I did not know
6. It simplifies the classroom situation	It does not simplify the classroom situation
7. It is useful for your prospective work as a professional teacher	It is not useful for your prospective work as a professional teacher
8. It helps you to become a critical member of society	It does not help you to become a critical member of society
9. It is boring	It is exciting
10. It is very vague (in fact, you do not know what it is all about)	It is very concrete (you know exactly what it is all about)
11. It is valuable for everyday life (for your interaction with other people)	It is not valuable for everyday life (for your interaction with other people)
12. It is very theoretical	It is very practical
13. It helps you understand yourself (and the development of your own personality) better	It does not help you to understand yourself (and the development of your own personality) better
14. These curriculum materials are pleasant to read	These curriculum materials are not pleasant to read
15. It helps you understand pupil behavior in probationary school better	It does not help you to understand pupil behavior in probationary school better

7.4.3 Grid ratings

7.4.3.1 Procedure

The final grid was put into the rating form, allowing the teachers a greater flexibility than the ranking form. Because the elements (components of the educational theory program, cf. section 7.4.2.1) were of course not identical for the two teachers' colleges, two different instruments were used for the two groups of teachers.

Each of the elements was printed at the top of one page. The rest of the pages were identical: they contained the 15 constructs and their contrast poles (cf. Table 54), a 7 point scale printed between the construct and its contrast pole. In this way each of the 21 elements was scored on each of the 15 constructs.
The instruments were completed by the 30 teachers that had participated in the main study. They were asked to complete the instruments at home and to send them back. The instructions for completing the form were on the first page and read as follows:

> "In this questionnaire 21 topics that were taught at teachers' college are brought to your attention. They are all topics from educational theory, like pedagogics, educational psychology, etc. The topics are at the top of the page. Sometimes some examples or references to a book are added in order to help you remember what that topic was about. As you will see, 15 questions are posed for each of the topics; these questions are the same for every topic. By means of these questions we are trying to find out how you experienced that topic in your teacher education program. You can answer the question by circling a number on a scale running from 1 to 7. [An explanation of details for filling out the questionnaire followed]".

All instruments were sent back within two weeks. There were no missing data.

7.4.3.2 Analysis: multidimensional scaling

Multidimensional scaling was employed to determine the structure in teachers' appraisal of the educational theory program. The rationale for most of the techniques used to analyze the Repgrid data is self-evident. With mul-

tidimensional scaling, however, some choices were made that need to be accounted for here. As explained in section 7.4.1, one of the main goals of the Repgrid investigation was detecting some basic structure in the teachers' appraisal of the total educational theory program. In any case this requires condensing the data (30 students rating 21 elements at 15 constructs) to a more simple structure. Techniques for condensing these type of data are described in, for example, Pope & Keen (1981) and Rathod (1982). In this study the main goal of the analysis was finding a number of dimensions behind the ways in which the educational program was appraised. Thereby it would be worthwhile if some information about the separate elements would emerge. Because within multidimensional scaling many non-metrical procedures are available and because elements and constructs can be depicted in the same space, these techniques seemed preferable to principal component analysis. Because we were interested in underlying dimensions, cluster analysis techniques were less obvious. Multidimensional scaling comprises a rich variety of techniques (cf. Coxon, 1982) that have in common that a set of empirical data is depicted by a set of points in space in such a way that the information contained in the set of empirical data is reflected as much as possible in the geometrical arrangement of the points in space. Because we were not interested in individual persons, we worked with the average score of each group. So our data set (for each of the two teachers' colleges) consisted of the average score for each element on each construct, being a 21 by 15 two-way and two-mode set of preference data. The 21 elements of the educational theory program were termed 'stimuli' in the analysis and the 15 constructs were termed 'subjects'.

Because there were no additional data that could be used to fix the subject points, the sets of stimulus points and subject points were to be estimated simultaneously, requiring one of the procedures for 'internal' analysis. Two programs from the MDS(X) library (cf. Coxon, 1982) could be used for our type of data, viz., MDPREF (MultiDimensional PREFerence scaling) or MINI-RSA (Michigan Israel Netherlands integrated Rectangular Space Analysis). At first sight, MINI-RSA seemed preferable, mainly because the distance model is more easily interpretable than the point-vector model. In MINI-RSA each subject (in this case, the 15 constructs for appraising the educational theory program) is depicted as an 'ideal point' in space. In the same space the stimuli (in this case, the 21 elements of the educational theory program) are depicted. In this joint space the rank order of the distances from the subject points to each of the stimuli are as close as possible to being in the same order as the subjects' preferences. So in our case those educational theory elements that were, for instance, on the average rated as 'very boring' are as much as possible depicted near this construct point. A problem arises when, as in this case, the several scales

are, with respect to content, of a diverse nature. For each of the scales the researcher has the choice of locating either the construct (e.g., 'difficult') or its contrast pole ('easy') at the 'upper end' of the scale. It will be clear that the final configuration depends highly on these choices, (i.e., those elements located near an ideal point 'difficult' will definitely be other ones than those elements located near the ideal point 'easy'). With our type of data, MINI-RSA could produce a number of solutions that all depicted the preferences in an adequate way. However, the arbitrariness just discussed made it preferable to use the MDPREF algorithm. In MDPREF the constructs are depicted as vectors in space. For our purpose this was extremely important, because the ends of the vector could be labeled with the construct pole name and the contrast pole name of each construct. When several vectors are oriented in space in the same way (i.e., when their angle in the origin is small) this means that the ratings of the components of educational theory on these constructs were analogous. The stimuli (the 21 elements of the educational theory program) were depicted as points. The meaning of each stimulus can be found on the basis of its location in relation to the subject vectors, namely, by noting how the stimuli project onto the subject vectors. When, for example, all stimulus points are projected onto the vector 'difficult--easy', those elements of the educational theory program that were considered most difficult by the teachers are projected onto the 'difficult' end of this vector. The position of the stimulus point will be chosen in such a way that the projection onto all vectors depicts as much as possible the original preferences. It is important to note that, compared to MINI-RSA, the MDPREF solutions are reported to often be a good deal more stable (Coxon, 1982).

7.4.3.3 Results

7.4.3.3.1 Teachers' opinions on the educational theory program

This section will first deal with teachers' appraisal of the educational theory program in general. This means that the average appraisals over the 21 components of the educational theory program will be used. The number 21 seems large enough not to be too dependent on accidental preferences or aversions to particular components of the educational theory program taught in a teachers' college. Great value is attached to these overall appraisals, especially because these appraisals are expressed by constructs that were generated by a group of teachers: the 15 constructs which were the

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result of the elicitation procedure (cf. section 7.4.2.2). The average appraisals of all teachers, specified for the two types of teachers' colleges (primary or secondary), are presented; the question at issue is to what degree the total educational theory program, according to the teachers, can be characterized as 'difficult', 'helpful for probationary school work', etc. An important aspect concerned the comparison between the two teachers' colleges, being an indication of the degree to which these data were dependent on local circumstances.
The average appraisals of the total educational theory program for both teachers' colleges are presented in Table 55, specified for the 15 constructs.

Table 55 Average appraisal of the total educational theory program, specified for the 15 constructs (For the meaning of the construct numbers see Table 54 or Figure 3).

Construct no.	Primary College		Secondary College	
	M	SD	M	SD
1	4.4	.84	4.9	.84
2	4.1	1.02	4.1	.80
3	2.7	.87	2.9	.72
4	4.3	.91	3.6	.97
5	4.4	.89	3.9	.79
6	3.4	.55	3.7	.32
7	2.4	.70	2.7	.74
8	3.7	.95	4.0	.65
9	4.3	.97	4.4	.88
10	4.5	.72	4.7	.73
11	4.2	1.20	4.0	1.12
12	3.8	.86	3.8	1.05
13	4.9	1.20	4.3	1.02
14	3.9	1.05	3.8	.74
15	4.0	1.18	4.0	1.05

The interpretation of the presented values for each construct of course depended on the ways in which the poles of each construct-scale has been labeled. To facilitate interpretation in Figures 3 and 4 the means, as well as the minimum and maximum values, are depicted on the 7-point scales of the 15 constructs, the poles of the scales being labeled.

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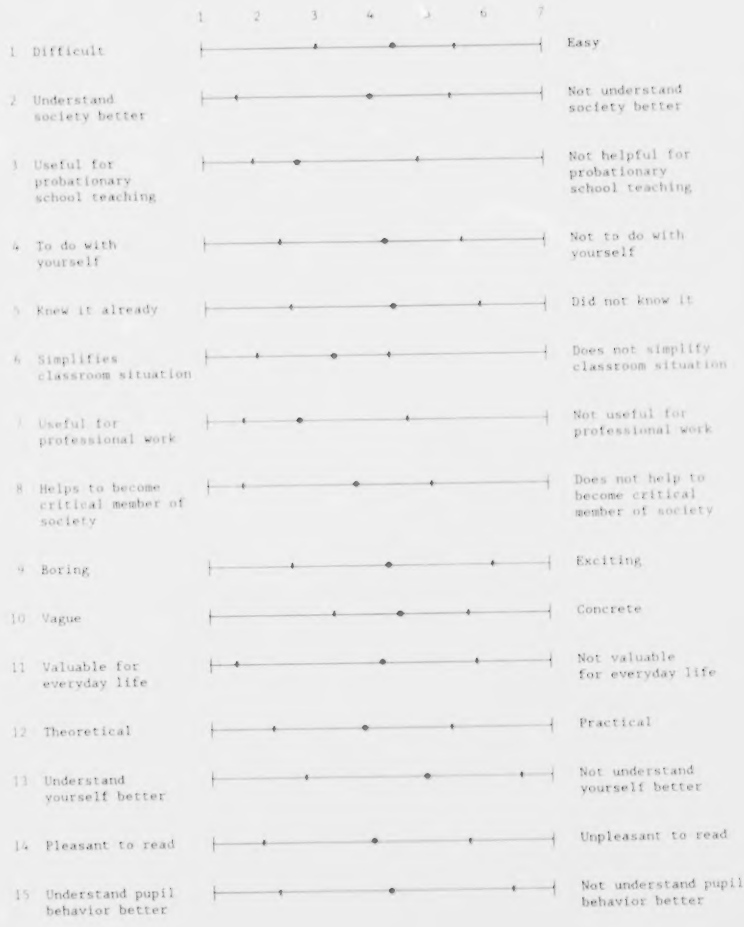
1 2 3 4 5 6 7
1 Difficult
Easy
2 Understand society better
Not understand society better
3 Useful for probationary school teaching
Not helpful for probationary school teaching
4 To do with yourself
Not to do with yourself
5 Knew it already
Did not know it
6 Simplifies classroom situation
Does not simplify classroom situation
7 Useful for professional work
Not useful for professional work
8 Helps to become critical member of society
Does not help to become critical member of society
9 Boring
Exciting
10 Vague
Concrete
11 Valuable for everyday life
Not valuable for everyday life
12 Theoretical
Practical
13 Understand yourself better
Not understand yourself better
14 Pleasant to read
Unpleasant to read
15 Understand pupil behavior better
Not understand pupil behavior better

Figure 3 Mean, minimum and maximum value of the total educational theory program, Sittard primary teachers' college.

1 2 3 4 5 6 7
1 Difficult
Easy
2 Understand society better
Not understand society better
3 Useful for probationary school teaching
Not helpful for probationary school teaching
4 To do with yourself
Not to do with yourself
5 Knew it already
Did not know it
6 Simplifies classroom situation
Does not simplify classroom situation
7 Useful for professional work
Not useful for professional work
8 Helps to become critical member of society
Does not help to become critical member of society
9 Boring
Exciting
10 Vague
Concrete
11 Valuable for everyday life
Not valuable for everyday life
12 Theoretical
Practical
13 Understand yourself better
Not understand yourself better
14 Pleasant to read
Unpleasant to read
15 Understand pupil behavior better
Not understand pupil behavior better

Figure 4 Mean, minimum and maximum value of the total educational theory program, Tilburg secondary teachers' college.

It can already be seen that the two teachers' colleges did not differ in the way they used the total scale range. The overall means of all scales (a number that of course has no content-related meaning) was 3.93 for the primary teachers' college and 3.92 for the secondary teachers' college, the SD's being .67 and .58 respectively.

It is clear that there is an apparent similarity between the two colleges regarding the appraisal of the components of the educational theory program. The correlation is .85 which is statistically significant at the .001 level. Thus, it can be concluded that even in this case when the two teachers' colleges are definitely different in character (in the sense that they are training prospective teachers for quite different school levels), there is a strong resemblance between teachers' opinions about the educational theory program. This is no doubt a remarkable result.

As to the general tendency that evolves from these appraisals, the following remarks can be made. According to the teachers, educational theory is useful for teaching practice, the usefulness for prospective professional work being somewhat higher than for probationary school teaching. An explanation for the latter result might be that in probationary school the teacher has to adapt to the working method of the collaborating teacher, which might hamper applying one's own (probably theoretically inspired) ideas about teaching. In the investigation this explanation was not verified. In any case it can be concluded that the perceived usefulness of educational theory for teaching is much higher than one would expect on the basis of frequently heard criticisms of educational theory programs. It may be that regularly there is annoyance about the fact that in educational theory the complexities of the classroom are not fully taken into consideration (the construct 'simplifies classroom situation' is scored on the positive side of the scale) or about the fact that a number of educational theory components are of no use at all (cf. section 7.4.3.3.3), but that on balance teachers do recognize the usefulness of educational theory. There is a favorable opinion about the concreteness of the components of educational theory: in general it is clear what it is all about. The potential contribution of educational theory to 'learn to know oneself better' is not estimated very high. The fact that the educational theory program is generally rated 'easy' can be evaluated in several ways. One could claim that those subjects that are seen as easy are automatically attractive to the prospective teacher. However, one could also wonder what the consequences of such an assessment will be for the 'image' of the subject at hand. It is even possible that the negative voices that are heard now and again about the educational theory programs have something to do with the following characterization of the subject: the educational theory program does not amount to much, it is a 'soft' subject and you can pass it without much effort. It is a generally well known phenomena that

people set much higher value on things that are acquired with hard work. Further research into this specific question is needed to determine whether this mechanism was in operation.

As explained in section 7.4.1, the appraisal of educational theory on the constructs 'useful for probationary school teaching' and 'useful for professional work' receives special attention. In the previous section it appeared that educational theory was certainly considered useful in this respect. The average scores on the two constructs on the 7-point scales, ranging from 'useful' (1) to 'not useful' (7), are specified in Table 56.

Table 56 Average scores on the two 'helpful for teaching' constructs, specified for the two teachers' colleges.

	Useful for probationary school teaching	Useful for professional work
Primary teachers' college	2.7	2.4
Secondary teachers' college	2.9	2.7

As can be seen from Figures 3 and 4, the 'usefulness for teaching' constructs are on the average rated the most extremely of all constructs that were used in characterizing the educational theory program.
In determining the 'usefulness for teaching', we were particularly interested in the components of educational theory that pertain to methods courses. Indeed the two educational theories in the experimental treatment are related to the method course components of the educational theory program. In fact, the two educational theories refer to two coherent sets of actions to be taken by the teacher in order to create a well-defined didactic situation in the classroom, namely, the presentation of an amount of related information or the organizing of role playing. It might be supposed that the teachers' appraisal of components that pertain to methods courses will not deviate much from their opinion about the two educational theories used in the main research. In section 7.4.2.1 for both teachers' colleges 21 components were presented that were rated by the teachers. From Table 53 it can be seen that for the primary teachers' college, 2 components pertain to methods courses (no. 4 and 17), while for the secondary teachers' college, 3 components pertain to it (no. 5, 10 and 14). The average 'usefulness for teaching' scores for the components concerned are given in Table 57, broken down into 'useful for probationary school teaching' and 'useful for professional work' ('1' meaning 'useful' and '7' meaning 'not useful').

Table 57 Average scores for the two 'useful for teaching' constructs, specified for the components of the educational theory program that pertain to methods courses.

	Component-number	Useful for probationary school teaching	Useful for professional work
Primary teachers' college	4	1.9	2.1
	17	1.9	1.8
	M	1.9	2.0
Secondary teachers' college	5	2.2	2.3
	10	1.7	1.7
	14	2.4	2.1
	M	2.1	2.0
Mean of two colleges		2.0	2.0

From this table it is clear that the usefulness of the components that pertain to methods courses is valued extremely high, even within the already high-rated 'usefulness for teaching' constructs (cf. Table 55). It appears that in this respect there are no differences between the two teachers' colleges.

Given the fact that the overall educational theory program at the two teachers' colleges was rated in a similar way on the 15 constructs, it is interesting to determine the similarity at the level of the separate components of the program. Because the components were of course not identical for the two teachers' colleges, direct comparison on a one-by-one basis was impossible. The following procedure was chosen. For each of the 15 constructs it was determined which two components were given the highest scores at this construct. In fact these two components could be seen as, in the view of the teachers, most clearly representing this particular construct. For example, at the teachers' college of secondary education the components 'choosing and assessing curriculum materials' and 'cognitive psychology and attribution theory' were the two components that rated highest on the construct 'difficult'. The result of this procedure is presented in Table 58. For every construct the components that are alike with respect to content are marked with an asterisk (*).

Table 58 Two components rated highest for each of the 15 constructs, specified for the two teachers' colleges.

	Primary teachers' college (Sittard)	Secondary teachers' college (Tilburg)
1. Difficult	History of education and pedagogics	Cognitive psychology and attribution theory
	Specifying instructional goals *	Choosing and assessing curriculum materials *
2. Helps understand society better	Psychology of adolescence	Education and the reproduction of social class differences *
	The role of school in society *	Innovations in the school system
3. Useful for probationary school teaching	Teaching methods in the questioning mode *	Teaching methods for acquiring and elaborating subject matter *
	Teaching methods on the soliciting mode *	Developmental psychology of adolescence
4. To do with yourself	The concept of 'adulthood' *	Skill and attitude in communication
	Psychology of adolescence	Developmental psychology of early adulthood *
5. Knew it already	The concept of 'adulthood'	Education and the reproduction of class differences
	Psychology of adolescence	The Dutch school system
6. Simplifies classroom situation	Innovations in the school system	Function and purpose of education in general
	Mixed-ability teaching *	Mixed-ability teaching *
7. Useful for professional teaching	Teaching methods in the soliciting mode *	Teaching methods for acquiring and elaborating subject matter *
	Schoolcurriculum development	Developmental psychology of adolescence
8. Helps become critical member society	Psychology of adolescence	Innovations in the school system
	The role of school in society *	Education and the reproduction of social class differences *
9. Boring	Governmental educational policy	The Dutch school system
	Specifying instructional goals *	Curriculum development *
10. Vague	Schoolcurriculum development *	Curriculum development *
	Governmental educational policy	Function and purpose of education in general
11. Valuable for everyday life	Psychology of adolescence *	Skill and attitude in communication
	The concept of 'adulthood'	Developmental psychology of adolescence *
12. Theoretical	Governmental educational policy	History of Dutch education *
	History of education and pedagogics *	Cognitive psychology and attribution theory
13. Understand yourself better	The concept of 'adulthood' *	Developmental psychology of early adulthood *
	Developmental psychology of primary school age	Developmental psychology of adolescence
14. Pleasant to read	Psychology of adolescence	Teaching methods for introduction
	The concept of 'adulthood'	Teaching methods for concluding a lesson
15. Understand pupils better	Developmental psychology of primary school age *	Developmental psychology of adolescence *
	Children with learning problems and behavioral problems	School as a subculture in society

From this table it appears that for 12 of the 15 constructs there is a common (i.e., strongly related) component that is rated the two highest by teachers of both the primary and the secondary teachers' colleges. On the ninth construct ('boring') the considering of commonality is based on the fact that the problem of instructional goals (rated as boring by the teachers from primary teachers' college) is normally treated within the framework of curriculum issues (rated as boring by the teachers form secondary teachers' college). The same holds for the first construct.
On the last construct ('understand pupils better') the component is considered 'common' despite the fact that not the same components were chosen; at the primary teachers' college 'developmental psychology of primary school age' was chosen, while at the secondary teachers college 'developmental psychology of adolescence' was one of the two highest. These choices are regarded as 'common' because it is obvious that they can be explained from the fact that the two groups of prospective teachers will be teaching two different pupil age groups. The assumed high usefulness of methods courses for teaching practice is in line with the data reported earlier in the section. It is noteworthy that all kinds of components that have something to do with the issues of instructional goals and of curriculum development are associated with the constructs of boring, vague and difficult. As already discussed earlier, their perceived difficulty need not, in view of the perceived overall easiness of the educational theory program, in itself be valued negatively. However, the combination with the constructs 'vague' and 'boring' indicates that the teacher educators did not succeed in 'bringing these issues to life' for the teachers. That components of developmental psychology are associated with a better understanding of oneself and others is not remarkable. It is remarkable that the teachers are unanimously of the opinion that those components that pertain to mixed-ability teaching simplify the complex classroom situation. One could imagine that negative experiences with, probably too ambitious, efforts of these inexperienced teachers with mixed-ability teaching are the basis of this opinion; determining whether this had been the case was not part of the investigation.

7.4.3.3.2 Teachers' opinions on the educational theory program as predictors of experimental results

One of the reasons for investigating teachers' appraisal of the educational theory program was that this appraisal might be used as a rival explanation (besides the effect of the experimental treatment) for the differences on the dependent experimental variables. If there are differences in the degree to which the teachers 'apply' the two educational theories in their

interactive cognitions or in their classroom behavior (which appears to be the case, cf. section 7.1 and 7.2), these differences might be (partly) attributable to the teachers' general appraisal of educational theory. Those teachers who set a relatively higher value on educational theory in general might be more inclined to assimilate a 'new' theory and subsequently use it themselves. What was investigated is the degree to which scores on the stimulated recall (measuring teachers' interactive cognitions) and on the classroom observation instrument (measuring teacher behavior) could be predicted from teachers' appraisal of the educational theory program. As was described in section 7.4.2.2, "teachers' appraisal of the educational theory program" was subdivided into 15 constructs. Thus, a choice had to be made regarding constructs which should be used as predictors (and thereby as potential alternative explanation for differences in the stimulated recall and classroom behavior scores). The most obvious choice is the set of constructs that refers to 'usefulness for teaching'. In the previous section it appeared that the 'usefulness for teaching' constructs are rated very high, particularly on those components that pertain to methods courses. Given the fact that our two educational theories (the Advance Organizer model and the Role Playing model) have a strong similarity to methods courses, it might be expected that if there is any effect of general appraisal of educational theory on the dependent variables whatsoever, it will manifest itself with the 'usefulness for teaching' constructs.

For each of the two 'usefulness for teaching' constructs, 'useful for probationary school teaching' (construct no. 3) and 'useful for prospective professional work as a teacher' (construct no. 7), the values for every teacher were determined by summarizing the scores of all components on this construct, resulting in two scores for every teacher, one for the 'usefulness for probationary teaching' and one for 'usefulness for prospective professional work' of the total educational theory program. These variables will hereafter be termed 'probationary' and 'professional' respectively. The third independent variable for every teacher is of course the experimental treatment he or she got (TT, T or C -group).

The dependent variables are the scores on the stimulated recall and the classroom observation instruments, both for the Advance Organizer and the Role Playing model. For all four measures the total score is taken (being the sum of the scores on the 12 theory elements of the Advance Organizer model and the sum of the 8 theory elements of the Role Playing model respectively).

A multiple regression analysis was performed, predicting from the 'probationary', 'professional' and 'group' variables successively the total stimulated recall score for the Advance Organizer model, the total stimulated recall score for the Role Playing model, the total teacher

behavior score for the Advance Organizer model and the total teacher behavior score for the Role Playing model. Because the first purpose of the multiple regression analysis was the determination of the relative weights of all three variables (without selecting variables for making actual predictions), all variables had to be included in the regression model. This was accomplished by using the backward elimination procedure and using the beta-weights from the first equation. The results of the four multiple regression analyses are summarized in Table 59.

Table 59 Results (beta-weights) of the four multiple regression analyses, the dependent variables being successively the total scores of the stimulated recall and teacher behavior on both teaching models (in parentheses the probabilities of the beta-weights).

	Stimulated recall Adv. Organizer	Stimulated recall Role Playing	Behavior Adv. Organizer	Behavior Role Playing
Exp. group	.89 (.000)	.85 (.000)	.90 (.000)	.92 (.000)
Probationary	.01 (.948)	.07 (.671)	.11 (.472)	.16 (.260)
Professional	.04 (.807)	.12 (.479)	.10 (.519)	.10 (.503)

From these results it is clear that teacher appraisal of the educational theory program does not contribute much to the scores on the dependent variables. The beta-weights of the constructs 'useful for probationary school teaching' and 'useful for prospective professional work' are very low for all of the four dependent variables; none of the relationships are statistically significant.

The total variance explained by the independent variables is high for all dependent variables, the adjusted R^2 being .75 for the stimulated recall score of the Advance Organizer model, .75 for the stimulated recall score for the Role Playing model, .76 for the teacher behavior score of the Advance Organizer model and .81 for the teacher behavior score of the Role Playing model. However, this is caused almost exclusively by the very significant relationship between experimental group membership and the dependent variables.

The general conclusion must be that positive or negative appraisal of the total educational theory program does not affect the more or less thorough application (neither cognitively nor in behavior) of the two educational theories that were incorporated into the treatment.

7.4.3.3.3 The structure of teachers' opinions: results of the multidimensional scaling

In section 7.4.3.2 it was explained why from the available multidimensional scaling techniques the MDPREF (MultiDimensional PREFerence analysis) algorithm was the most appropriate one to select here. In the MDPREF analysis the constructs for appraising the educational theory program were used as 'subjects' (i.e., the vectors that are used to interpret the joint n-dimensional space), while the components that comprise the educational theory program were considered the 'stimuli' (i.e., the points that can be projected onto the vectors for interpretation). Within the framework of the present study the position of the vectors was the most interesting. Their position with respect to each other reflects their relationship: for those constructs that have a similar orientation in space it holds that the components of the educational theory program were rated analogously on those constructs. One of the goals of this analysis was to determine whether, on the basis of their orientation in space, the constructs grouped into related sets. Focusing on these constructs was particularly interesting because the same constructs were used with the two teachers' colleges, making it possible to determine the similarity between them. The data of the primary teachers' college were analyzed first. Choosing the number of dimensions was based on the scree plot of the roots of the first score matrix. The following roots were found: 153.3 52.2 17.2 13.1 11.4 5.1 4.4 3.2 2.8 2.2 1.3 0.6 0.4 0.3 and 0.1. Thus, there appeared to be a distinct break between the 'steep slope' of the large roots and the gradual trailing off of the rest of the roots. As the first two roots amounted to (205.5 / 267.6 =) 77% of the total value, the two-dimensional solution was chosen. The two-dimensional solution for the primary teachers' college is presented in Figure 5. In this figure only the vectors are drawn. Notice that, e.g., the vectors 'concrete' and 'practical' virtually coincide.

In this figure there appear to be four discernable and interpretable groups of constructs that are oriented in the same direction within the two-dimensional space and that are also related with respect to content. They are labeled here as 'teaching', 'society', 'personal/social' and 'subject matter':

1. Teaching: 'useful for probationary school teaching' and 'useful for professional work'.
2. Society: 'understand society better' and 'critical member of society'.
3. Personal/social: 'valuable for everyday life', 'understand yourself better' and 'has to do with yourself'.
4. Subject matter: 'practical', 'concrete', 'easy', 'pleasant to read' and 'exciting'.

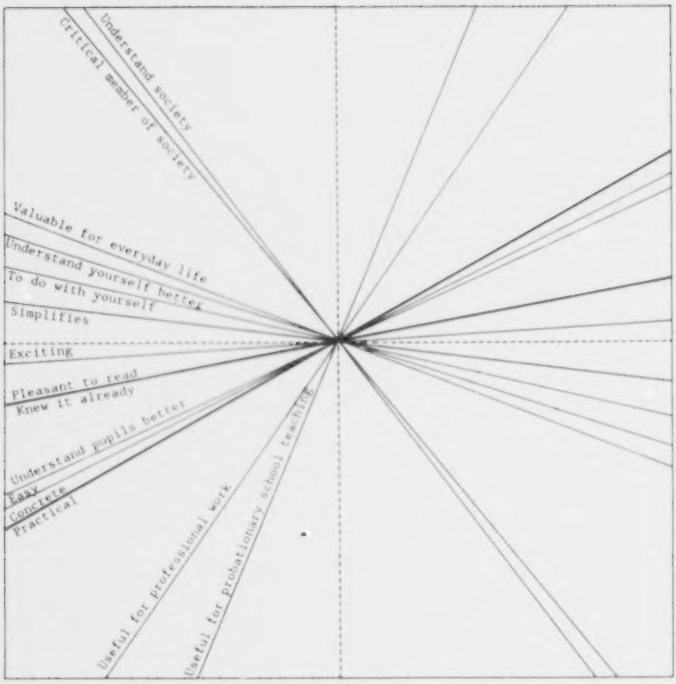

Figure 5 MDPREF solution for the vectors representing the constructs for appraising the educational theory program (Sittard primary teachers' college).

Within the last group is also situated the vector 'understand pupils better', which would in fact (as regard to content) 'belong' in the third group.

It should be noted that the 'subject matter' group differs from the other three groups in the sense that the constructs from this group do not refer to the function of educational theory for 'external' purposes, but instead to characteristics of educational theory itself. Here educational theory is viewed as subject matter, taught at the teachers' college, which can be more or less easy, pleasant to read, etc.

The two constructs 'knew it already' and 'simplifies classroom situation' are not covered by the grouping of the constructs just presented. Because their meaning does not match the labels of one the four groups, these two constructs must remain isolated.

It may be concluded that teachers of this teachers' college, if asked for their opinion about the educational theory program, can generate a large number of constructs (cf. section 7.4.2.2), but that in fact this number of constructs can be reduced to a few groups of related ones.
The first one has to do with teaching, which in section 7.4.3.3.1 appeared to be the most extremely rated aspect of 'appraisal of educational theory'. It also appeared that the components pertaining to methods courses were associated with these 'useful for teaching' constructs. The second group concerns the influence the educational theory program in teacher education can have on teachers' understanding of and behavior in society. This group appeared to be related to theory components about the role of school in society, problems of inequality, etc. The group of constructs that was labeled 'personal/social' refers to the fact that certain components of the educational theory program may facilitate the teacher's understanding of human behavior. In section 7.4.3.3.1 it appeared that these constructs were mainly associated with theory elements from developmental psychology. The last group of 'subject matter' constructs pertains to something like the (dis)pleasure the teachers derive from studying educational theory. The fact that a great number of these kinds of constructs are present (i.e., are raised by a group of teachers, cf. section 7.4.2.2) means that in the teachers' view this aspect of educational theory is an important one.

An essential question is of course whether the structure just described can also be found in the secondary teachers' college data. From section 7.4.3.3.1. it appeared that the correlation between the two teachers' colleges at the level of the separate constructs was rather high, but this does not necessarily mean that they will have the same dimensional structure. The relevant information for the secondary teachers' college is presented in Figure 6.
Compared to the solution of the primary teachers' college constructs, it appears that for the present data

** also here is a group of constructs that can be labeled 'personal/social' (to do with yourself; valuable for everyday life; understand pupils better; understand yourself better);
** also here the 'society' constructs (understand society better; critical member of society) are oriented in the same direction.
** also here the two 'teaching' constructs (useful for professional work; useful for probationary school teaching) are definitely oriented in the same direction; however, their orientation in space without separation merges into a rather broad cluster, which is comprised of
** 'subject matter' constructs (exciting; pleasant to read; easy; practical; concrete).

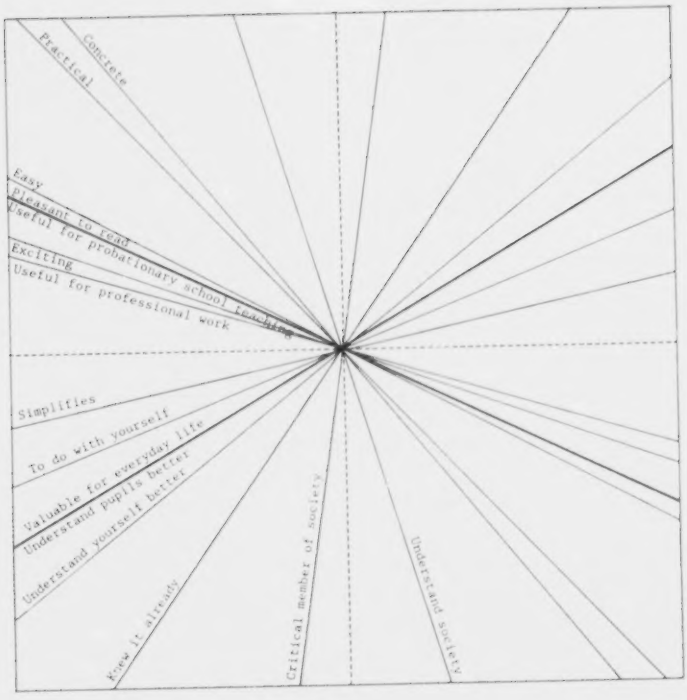

Figure 6 MDPREF solution for the vectors representing the constructs for appraising the educational theory program (Tilburg secondary teachers' college).

It can be concluded that the structure in teachers' appraisal of the educational theory program is highly analogous for the two teachers' colleges. However, the teachers of the Tilburg secondary college associate usefulness of educational theory for teaching practice directly with qualities like 'easy', 'pleasant to read' 'practical' and 'concrete'. In other words, they make, in contrast to the teachers from the Sittard primary teachers' college, no sharp distinction between 'teaching' constructs and 'subject matter' constructs.

A possibility of the MDPREF program is to depict both the constructs and the theory components in the same dimensional space. In Figure 7 and 8 this

has been done for the Sittard primary and the Tilburg secondary teachers' college respectively. The numbers 1 to 21 in the center of the figures correspond to the components of the educational theory programs as defined in Table 53 (section 7.4.2.1).

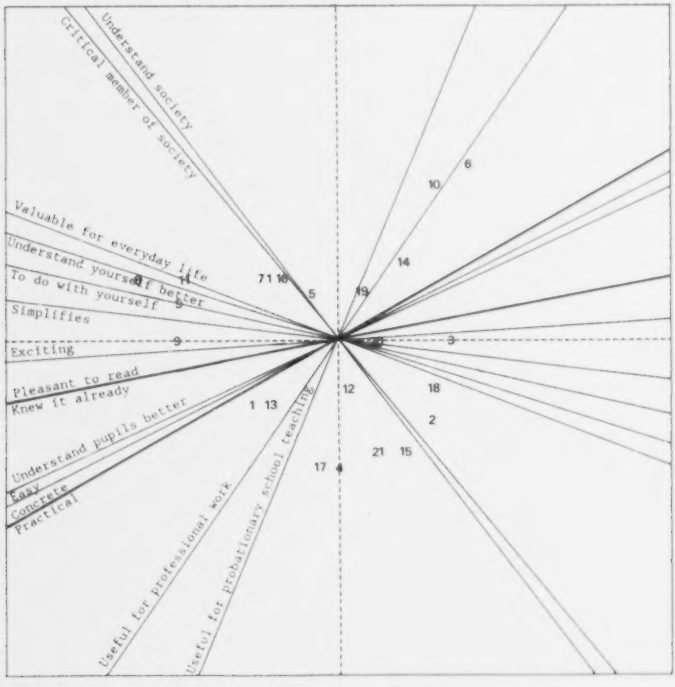

Figure 7 Complete MDPREF solution (joint space) for the Sittard teachers' college data

As explained in section 7.4.3.2, the meaning of the theory components in these figures can be derived from their projections onto the construct vector. For example, it appears that in Figure 7 the projection of theory component 8 ('psychology of adolescence') is high on the construct vectors of, for example, 'to do with yourself'.

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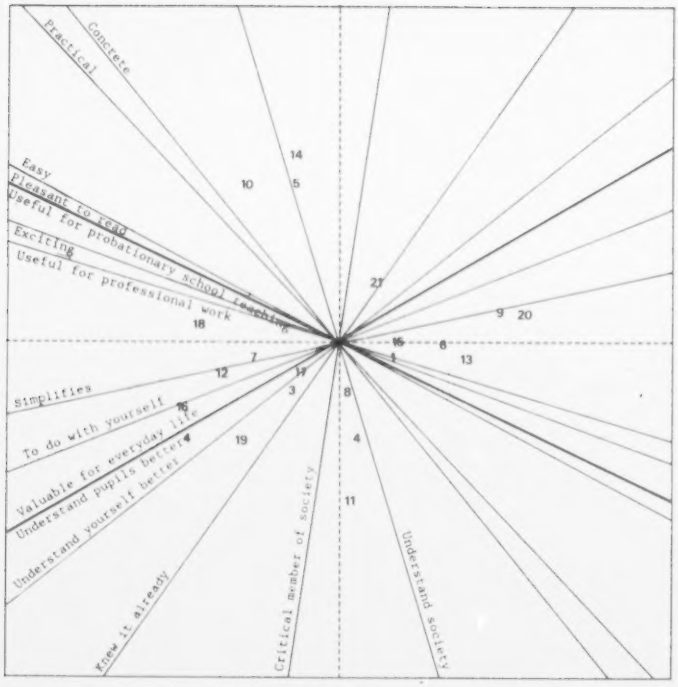

Figure 8 Complete MDPREF solution (joint space) for the Tilburg teachers' college data

A problem in comparing the two figures is of course that the content of the theory components 1 to 21 is different for the two teachers' colleges. However, when the theory components that are related in content are taken into consideration there appears to be a remarkable analogy. This was already noticed in section 7.4.3.3.1, but the present analysis shows these matters in a more detailed way. Of course it is impossible to comment on every separate element. A few noteworthy results are mentioned here:

a. The theory components that pertain to developmental psychology always project onto the positive ('favorable') side of the vectors that were characterized as belonging to the group of 'personal/social'. For the primary teachers' college (Figure 7) the theory components 8, 9, 11 and 16 are involved, while for the secondary teachers' college (Figure 8) these are the theory elements 8, 16 and 19.

b. The theory components that pertain to methods courses are without exception located at the positive end of the 'useful for teaching' constructs. For the primary teachers' college: theory components 4 and 17. For the secondary teachers' college: theory components 5, 10 and 14.
c. The theory components that pertain to history of education (for the primary teachers' college being no. 10 and for the secondary no. 20) are projected on the positive side of the 'society' group of constructs, but on the negative ('unfavorable') side of all other groups of constructs.
d. The same holds for those theory components that pertain to innovations in the school system (no. 14 for the primary teachers' college and no. 15 for the secondary).
e. The theory components that pertain to (school) curriculum development or to instructional goals (no. 3 and 18 for the primary teachers' college and for the secondary teachers' college no. 9 and 21) are located at the unfavorable side of all four construct groups.

7.4.3.4 Comparing findings to a second sample

7.4.3.4.1 Introduction

The data about teachers' appraisal of educational theory were gathered for several reasons. One of them was to determine whether teachers' appraisal of educational theory could function as a rival explanation for experimental effects (cf. section 7.4.3.3.2). Besides, it was deemed meaningful to depict, within the framework of this investigation, the opinions of the teachers about the educational theory program. One of the problems in this respect was that in connection to the main study the sample size had to be small because of the labor-intensive procedures that were employed there (cf. section 6.2). When, however, as is the case in the present part of the study, purely descriptive data are gathered, it is advisable to validate the data with a second sample that is comparable to the first one. For this reason, two other teachers' colleges were requested to participate in the study, one for primary teacher education (in Nijmegen) and one for secondary teacher education (in Leeuwarden). The choice of the teachers' colleges was based on the researcher's existing contacts with teacher educators at these teachers' colleges. The teachers' colleges had not participated in earlier stages of the investigation.
The procedure was exactly the same as the procedure followed with the other two teachers' colleges. The teacher educators were asked to subdivide the educational theory program into 21 components which are given a comparable amount of attention and to specify each component in such a way ('Chapter X

in book Y', etc.) that it could be easily recognized by the teachers. This resulted in 21 theory components for each of the two teachers' colleges. They are presented in Table 60.

Table 60 Educational theory components of the Nijmegen primary teachers' college and the Leeuwarden secondary teachers' college.

Primary (Nijmegen)	Secondary (Leeuwarden)
1. Educational psychology	1. Psychology of problem solving
2. Social-emotional climate in the classroom	2. Skills in communication
3. Teaching methods for promoting pupils' self-activation	3. Formal and informal groups in the classroom
4. Teaching methods in the conversational mode	4. Teaching methods as treated in the first year's course
5. Teaching methods in the presentational mode	5. Teaching methods as treated in the second year's course
6. History of pedagogics	6. Didactics of problem solving
7. Children with learning problems	7. History of education in The Netherlands
8. School legislation	8. The Dutch school system
9. Innovations in education	9. Innovations in the school system
10. Mixed-ability teaching and education	10. Mixed-ability teaching
11. The role of education in society	11. Effects of social inequality
12. Developmental psychology of primary school age	12. Developmental psychology of the age 0 to 12
13. Developmental psychology of adolescence	13. Developmental psychology of adolescence
14. Adulthood (in the framework of developmental psychology)	14. Developmental psychology of (early) adulthood
15. Schoolcurriculum development	15. General theory of curriculum development
16. Innovators in education like Montessori, Petersen.	16. Theory of models of teaching (as an aid in curriculum development)
17. Specifying instructional goals	17. How to use models of teaching for the development of own curricula
18. Evaluation and testing	18. Curricula with built-in possibilities for mixed-ability teaching
19. Educational observation	19. Innovators in education, like Montessori
20. Breaking down gender role patterns in education	20. How to make tests with essay questions
21. Sex education	21. How to make multiple choice tests

The same 15 constructs that were used with the teachers' colleges of the first sample were used for these instruments. After the groups of teachers expressed their willingness to participate in the study, at each of the

teachers' colleges 15 teachers in their third year of training were randomly selected to fill in the questionnaires. All teachers returned the questionnaires. There were no missing data.

7.4.3.4.2 Teachers' opinions on the educational theory program.

An important issue for comparing the first sample (primary teachers' college Sittard and secondary teachers' college Tilburg) to the second one (primary teachers' college Nijmegen and secondary teachers' college Leeuwarden) was of course the appraisal of the educational theory program in general, taking the mean score of all educational theory components for every construct. The averages (and standard deviations) of all teachers' colleges are presented in one table (Table 61).

Table 61 Average appraisal (for each teachers' college) for the total educational theory program, specified for the 15 constructs. (For the meaning of the construct numbers see Figure 9 or Table 54).

Construct no.	Sittard primary college		Tilburg secondary college		Nijmegen primary college		Leeuwarden secondary college	
	M	SD	M	SD	M	SD	M	SD
1	4.4	.84	4.9	.84	4.6	.71	4.1	1.07
2	4.1	1.02	4.1	.80	4.1	.90	4.4	.93
3	2.7	.87	2.9	.72	2.7	.67	2.9	.79
4	4.3	.91	3.6	.97	4.0	.87	3.8	.59
5	4.4	.89	3.9	.79	4.0	.66	4.5	.91
6	3.4	.55	3.7	.32	3.8	.46	3.7	.41
7	2.4	.70	2.7	.74	2.6	.49	2.5	.66
8	3.7	.95	4.0	.65	3.8	.73	4.4	.89
9	4.3	.97	4.4	.88	4.5	1.05	4.4	.55
10	4.5	.72	4.7	.73	4.7	.65	4.5	.76
11	4.2	1.20	4.0	1.12	4.2	.85	4.9	.61
12	3.8	.86	3.8	1.05	4.0	.91	4.1	.94
13	4.9	1.20	4.3	1.02	4.6	1.01	4.8	.87
14	3.9	1.05	3.8	.74	3.7	.84	4.1	.59
15	4.0	1.18	4.0	1.05	3.7	.99	4.3	.84

In order to facilitate comparison with the data from the first sample as depicted in Figure 3 and 4, the data of the Nijmegen primary and the Leeuwarden secondary teachers' college were also displayed in figures of that kind (see Figure 9 and 10 respectively).

1 2 3 4 5 6 7
1 Difficult
Easy
2 Understand society better
Not understand society better
3 Useful for probationary school teaching
Not helpful for probationary school teaching
4 To do with yourself
Not to do with yourself
5 Knew it already
Did not know it
6 Simplifies classroom situation
Does not simplify classroom situation
7 Useful for professional work
Not useful for professional work
8 Helps to become critical member of society
Does not help to become critical member of society
9 Boring
Exciting
10 Vague
Concrete
11 Valuable for everyday life
Not valuable for everyday life
12 Theoretical
Practical
13 Understand yourself better
Not understand yourself better
14 Pleasant to read
Unpleasant to read
15 Understand pupil behavior better
Not understand pupil behavior better

Figure 9 Mean, minimum and maximum value of the total educational theory program (Nijmegen primary teachers' college)

1 2 3 4 5 6 7
1 Difficult
Easy
2 Understand society better
Not understand society better
3 Useful for probationary school teaching
Not helpful for probationary school teaching
4 To do with yourself
Not to do with yourself
5 Knew it already
Did not know it
6 Simplifies classroom situation
Does not simplify classroom situation
7 Useful for professional work
Not useful for professional work
8 Helps to become critical member of society
Does not help to become critical member of society
9 Boring
Exciting
10 Vague
Concrete
11 Valuable for everyday life
Not valuable for everyday life
12 Theoretical
Practical
13 Understand yourself better
Not understand yourself better
14 Pleasant to read
Unpleasant to read
15 Understand pupil behavior better
Not understand pupil behavior better

Figure 10 Mean, minimum and maximum value of the total educational theory program (Leeuwarden secondary teachers' college).

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The data from the second sample are highly similar to the first sample data. Also here it appears that the usefulness of educational theory for probationary school teaching and for professional work is estimated as being rather high, notwithstanding the fact that in theory reality may be somewhat simplified. Also here educational theory is deemed quite concrete, while the potential value of educational theory for a better self-understanding is not estimated too high. Although the secondary college teachers are somewhat less distinct in this respect, educational theory is assessed as being easy rather than difficult.
The correlation between the teachers' colleges from the first sample at the appraisal of the educational theory program was very high (.85). Now it appears that the average correlation between all teachers' colleges is still very high (.87). All correlations are presented in Table 62.

Table 62 Correlations between the four teachers' colleges for the set of 15 constructs for appraising the total educational theory program

	Sittard primary college	Nijmegen primary college	Tilburg secondary college	Leeuwarden secondary college
Sittard	1.00			
Nijmegen	.93	1.00		
Tilburg	.85	.94	1.00	
Leeuwarden	.89	.85	.79	1.00

There appears to be a very strong average agreement between the teachers of the four teachers' colleges about the appraisal of the educational theory program. All correlations are statistically significant at the .001 level.

Just as in the first sample, the teachers from the Nijmegen and Leeuwarden teachers' colleges esteemed the educational theory program's usefulness for teaching practice as being high. The data are about the same for the two samples. The data for all teachers' colleges are presented in Table 63.

Table 63 Average scores at the two 'helpful for teaching' constructs, specified for the four teachers' colleges.

	Probationary		Professional	
Primary Sittard	2.7		2.4	
Secondary Tilburg	2.9		2.7	
Mean		2.8		2.55
Primary Nijmegen	2.7		2.6	
Secondary Leeuwarden	2.9		2.5	
Mean		2.8		2.55

As with the first sample (cf. Table 58), it was determined for every construct which two theory components had been given the highest scores. The most interesting question was of course to what degree the results from Table 58 could be reproduced with the second sample. In the first sample there were 'common' theory components (i.e., theory components that were similar with respect to content and that belonged to the two highest scored components of both teachers' colleges) for 12 out of the 15 constructs. In Table 58 the 'common' theory components were marked with an asterisk (*).
The same procedure was followed with the second sample. The two theory components that scored the highest on every construct are listed in Table 64. Only if a component is similar with respect to content *to the 'common' element of the same construct in Table 58* is it labeled with an asterisk (*).
From this table it appears that of the 13 constructs for which a common component was found in Table 58, there are 7 constructs that have the same component in the new sample (in both teachers' colleges), while there are an additional 3 constructs for which the same component is found in one of the two teachers' colleges from the second sample. More specifically, what appears to be untenable is characterizing 'history of education' as a component which is judged extremely 'theoretical', characterizing components about inequality in education and the role of school in society as promoting a critical view of society and, finally, characterizing the components about mixed-ability teaching as typically simplifying the classroom situation.
For 7 of the 13 constructs the results from the first sample correspond exactly to those of the second sample, while for 3 constructs these results hold for one of the two teachers' colleges.

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Table 64 The two theory components rated highest on each of the 15 constructs, specified for the Nijmegen primary and the Leeuwarden secondary teachers' college.

	Nijmegen primary teachers' college	Leeuwarden secondary teachers' college
1. Difficult	School legislation	General theory of curriculum development (*)
	Specifying instructional goals (*)	How to use models of teaching for the development of own curricula (*)
2. Helps understand society better	Breaking down gender role patterns in education	Effects of social inequality in education (*)
	The role of education in society (*)	Formal and informal groups in the classroom
3. Useful for probationary school teaching	Mixed-ability teaching	Teaching methods as treated in the second year's course (*)
	Teaching methods for promoting pupils' self-activation (*)	How to make tests with essay questions
4. To do with yourself	Sex education	Developmental psychology of adolescence
	Breaking down gender role patterns in education	Developmental psychology of (early) adulthood (*)
5. Knew it already	Teaching methods in the conversational mode	The Dutch school system
	Sex education	Skills in communication
6. Simplifies classroom situation	Teaching methods for promoting pupils' self-activation	Theory of models of teaching (as an aid in curriculum development)
	Teaching methods in the conversational mode	Teaching methods as treated in the second year's course
7. Useful for professional teaching	Teaching methods for promoting pupils' self-activation (*)	Teaching methods as treated in the first year's course (*)
	Teaching methods in the conversational mode (*)	Teaching methods as treated in the second years's course (*)
8. Helps become critical member society	Breaking down gender role patterns in education	Innovations in the school system
	History of pedagogics	Innovators in education, like Montessori
9. Boring	School legislation	The Dutch school system
	Schoolcurriculum development (*)	Theory of models of teaching (as an aid in curriculum development) (*)
10. Vague	Schoolcurriculum development (*)	How to use models of teaching for the development of own curricula (*)
	School legislation	Theory of models of teaching (as an aid in curriculum development) (*)
11. Valuable for everyday life	Breaking down gender role patterns in education	Formal and informal groups in the classroom
	Adulthood (in the framework of developmental psychology)	Developmental psychology of adolescence (*)
12. Theoretical	School legislation	General theory on curriculum development
	Schoolcurriculum development	Theory of models of teaching (as an aid in curriculum development)
13. Understand yourself better	Breaking down gender role patterns in education	Developmental psychology of (early) adulthood
	History of pedagogics	Formal and informal groups in the classroom
14. Pleasant to read	Developmental psychology of adolescence	Formal and informal groups in the classroom
	Developmental psychology of primary school age	Developmental psychology of (early) adulthood
15. Understand pupils better	Social emotional climate in the classroom	Developmental psychology of adolescence (*)
	Developmental psychology of primary school age (*)	Formal and informal groups in the classroom

7.4.3.4.3 The structure of teachers' opinions

The data of the second sample were scaled by the same procedure (MDPREF) as the data of the first one. Because constructs that had been used were identical, attention was focused on the way in which the constructs were grouped in space. In the first sample it was determined that the constructs, on the basis of their orientation in space, could be arranged into four groups, labeled 'teaching', 'society', 'personal/social' and 'subject matter' (cf. section 7.4.3.3.3).
In Figure 11 the solution for the Nijmegen primary teachers' college is presented. It appears that there is a strong resemblance to the MDPREF solution of the first sample teachers' colleges, especially the Sittard primary teachers' college (cf. Figures 5 and 7):

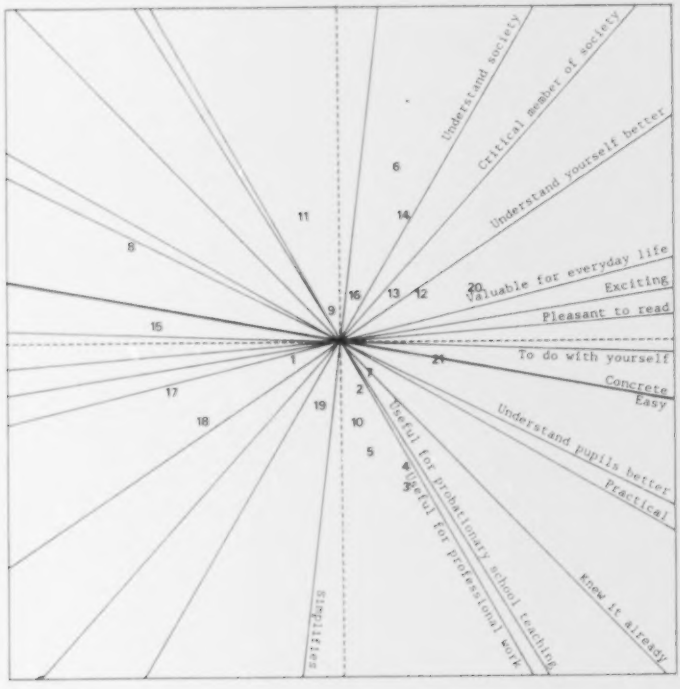

Figure 11 Complete MDPREF solution (joint space) for the Nijmegen teachers' college data

* also here in the two-dimensional space there is a clearly discernable 'teaching' direction (useful for probationary school teaching; useful for probationary work);
* also here the 'society' constructs have the same orientation in space, (understand society; helps become critical member of society);
* there is a 'subject matter' group, (exciting; pleasant to read; concrete; easy; practical). The first four of this group are coherently in one direction. The fifth diverges from this main direction;
* the group of 'personal/social' constructs is recognizable as such, but is somewhat problematic because (1) it fans out rather broadly and (2) overlaps with the 'subject matter' group. Apparently, particularly that part of the components receive 'favorable' subject matter characteristics for which it holds that these components are also helpful for a better understanding of oneself or others. In any case these two groups of characteristics are, in the perception of the teachers, intermingled.

The MDPREF solution for the Leeuwarden secondary teachers' college is presented in Figure 12.
Just like with the Nijmegen primary teachers' college data, it is clear that the 'subject matter' group and the 'personal/social' group are oriented in a discernible direction in space (in this case the 'subject matter group fanning out relatively more), but that these groups overlap. The orientation in space of both the 'teaching' group and the 'society' group is very clearly discernible. However, these two groups overlap. There is no obvious interpretation of that overlap.

Summarizing, it may be said that the four groups of constructs that were discerned in the first sample are also present in the second one, in the sense that those constructs that were regarded as belonging to one of the four groups ('teaching', 'personal/social', 'society' and 'subject matter') are always oriented in space as a group, meaning that the educational theory components were rated analogously on these constructs. However, it also holds that a certain degree of overlap between the groups may occur, especially between the 'subject matter' group and other ones. While in the Tilburg teachers' college positive aspects of subject matter are associated with usefulness for teaching (the 'teaching' group), in the Sittard and Leeuwarden teachers' colleges the positive aspects of subject matter are associated with gaining a better understanding of oneself and others, ('personal/social' group).

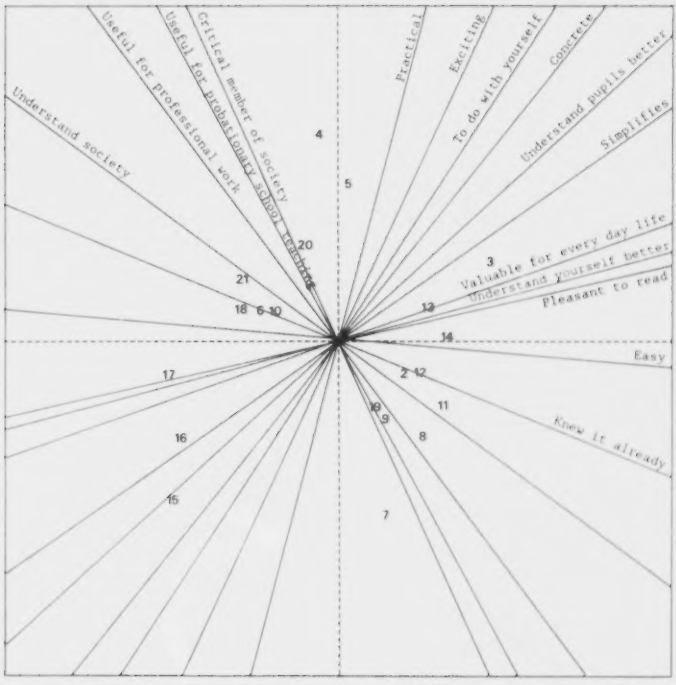

Figure 12 Complete MDPREF solution (joint space) for the Leeuwarden teachers' college data.

The exact position of a number of theory components in the joint space of constructs and components was discussed at the end of section 7.4.3.3.3. The most salient matters were reviewed in points 'a' through 'e'. From Figures 11 and 12 (for the meaning of the number in the center of the Figures, see Table 60) it can be seen that the statements made in section 7.4.3.3.3 also hold for the data of the Nijmegen and the Leeuwarden teachers' colleges, with the exception of the statement made under point "c": at the Nijmegen teachers' college the 'history of education' component is projected onto the 'favorable' side of most construct groups, while at the Leeuwarden teachers' college the component is projected on the 'unfavorable' side of most construct groups. It can be said that in general the conclusions about the position of separate components, made on the basis of the first sample data, also hold for the second sample.

7.4.4 Conclusions

The five research questions that were about teachers' appraisal of educational theory (cf. section 6.4), concerned the differences between the teachers' colleges regarding the teachers' opinions about the educational theory program (research question d1), the structure of the teachers' opinions as it appeared from the multidimensional scaling (d2 and d3) and the possible use of "teachers' appraisal of educational theory" as an alternative explanation for experimental effects, i.e., scores on stimulated recall and teacher behavior (d4 and d5).
Because the descriptive findings were validated with a second sample, the data of four teachers' colleges were available for answering the first three questions.

As to the first research question, the appraisals of the educational theory program in terms of the 15 constructs generated by the student-teachers were quite analogous. The average correlations between the four teachers' colleges was .87. Given the fact that in this sample there are two teachers' colleges for primary and two for secondary education and that there has been not any mutual contact between the colleges, this is a remarkable result: apparently there is a very high consensus among prospective teachers in general about the characteristics of the educational theory program, even if this concerns programs from different types of teachers' colleges.

From the investigation into the structure of the teachers' opinions about the educational theory program (research questions d2 and d3), it appeared that the constructs for characterizing the educational theory program could be meaningfully ordered into four groups, in the sense that the constructs belonging to such a group were always oriented in the same direction in the scaling solutions. This indicates that the elements of the educational theory program were rated analogously on these constructs. The first group concerns the usefulness of the educational theory program for teaching in practice, the second one concerns the influence this program can have on teachers' understanding of society in general, the third group pertains to the fact that certain components of the educational theory program may promote one's understanding of human behavior, while the last group refers to the educational theory as 'subject matter' taught in college, which can be more or less difficult, boring, etc. Although these four groups were discernable (in the sense just described) in all teachers' colleges, the colleges differed as to the amount of overlap that existed between the groups. For example, in both the Nijmegen and the Leeuwarden teachers' college there was overlap between the third and the fourth group, indi-

cating that no sharp distinction was made between subject matter characteristics and the usefulness of program components for a better understanding of human behavior.
As a general conclusion it can be stated that, when the teachers' colleges are compared, there is a striking similarity between the teachers' opinions about the educational theory program and that this similarity also manifests itself to some degree when these opinions are expressed in a dimensional structure.

The final two research questions (d4 and d5) pertained to the relative importance of teachers' appraisal of the educational theory program on teachers' stimulated recall or behavior scores, compared to the influence of the experimental treatment. In the analyses the most 'promising' constructs from teachers' appraisal of the educational theory program were chosen (viz., 'useful for probationary school teaching' and 'useful for prospective professional work as a teacher'). From the multiple regression analyses it appeared that this information about teachers' appraisal of the educational theory program added practically nothing to the stimulated recall or teacher behavior results. So, in the interpretation of the experimental effects no adjustments need to be made because of the teachers' appraisal of the educational theory program.

7.5 Additional research topics

7.5.1 Relationship between videotest scores and experimental variables

In section 6.1 it was explained that the basic purpose of using the video materials was no more than to provide an opportunity for a practice-oriented confrontation with and evaluation of the pertinent educational theories. The second step, being the subject of the present investigation, concerned the question whether this kind of treatment had an observable effect on teachers' interactive cognitions and teaching behavior. In sections 7.1 and 7.2 the investigation was reported from which it appeared that there was such an observable effect: compared to the teachers who got a purely verbal introduction to the two educational theories, the teachers who got the additional video treatment demonstrated a greater ability to employ the educational theories, both cognitively and in their behavior.
Given the differences between the experimental groups on the dependent variables, an interesting question concerns the relationship between the teachers' scores on the videotest and their scores on the experimental

variables (i.e., their stimulated recall scores and teacher behavior scores). Of course such a relationship could only be determined with those teachers that went through both the video treatment and the measuring of their cognitions and actions (the T & T group). The small size of this sample (which was inevitable for a number of reasons, see section 6.2), however, makes it very difficult to investigate this relationship; determining a correlation can, with this sample size (n = 10), only be interpreted as an indication.
The videotest scores and the total scores of both the stimulated recall and the teacher behavior instrument were correlated for the Advance Organizer model as well as the Role Playing model. The results are presented in Table 65.

Table 65 Correlations between videotest scores and scores on the stimulated recall and teacher behavior instrument, specified for the Advance Organizer and Role Playing model.

	Advance Organizer Model	Role Playing Model	M
Correlation between videoscore and stimulated recall	.46	.37	.42
Correlation between videoscore and teacher behavior	.59	.54	.57
M	.53	.46	.50

It is not remarkable that with this small sample size these correlations are not statistically significant. For that reason no positive conclusions can be drawn about the relationship between videotest scores and the experimental variables (research question e1; cf. section 6.4), making it also pointless to compare the Advance Organizer and the Role Playing model in this respect (research question e2).

7.5.2 The influence of the experimental treatment on lesson planning

The planning of the 60 lessons that were given in the main study was not investigated in depth. Apart from the fact that inevitably choices had to

be made, an important consideration was that an investigation into the planning process could interfere with answering the main research questions (the effect of the treatment on teachers' interactive cognitions and actions) in a valid way. Interrogation of teachers about their planning directly after the planning took place could confound both the stimulated recall data and the teacher behavior data, while interrogation directly after the lesson would almost certainly confound the stimulated recall data.

In this study all teachers were asked to make a written lesson plan which is, for that matter, a normal activity in the teachers' colleges.

The most important question concerning the lesson planning was whether the three experimental groups differed as to the employment of the pertinent educational theories in their lesson planning.

There were great differences in the degree of detail in the lesson plans. For this reason any comparisons between the groups that were based on counting the number of references to the educational theories that could be discerned were of little value; this would lead to increasing the scores of those teachers who were inclined to make detailed written lesson plans. In the scoring of the lesson planning a much simpler criterion was used: it was determined whether each of the 12 (Advance Organizer lessons) or 8 (Role Playing lessons) theory elements occurred at least once in the lesson planning. This procedure was somewhat unsatisfactory for some theory elements, in the sense that the 'occurrence' of that theory element could principally manifest itself in a number of ways. This is especially the case with the Role Playing model. These matters have already been extensively documented in the sets of decision rules for coding the videotapes (see Appendix V). For example, theory element 1 of the Role Playing model, 'providing the pupils with sufficient details' is recorded when (1) the teacher briefly summarizes the problem situation, or (2) describes the characteristics of the leading actors, or (3) describes the concrete situation and location in which the role playing will take place; when, as in the present case with coding the lesson planning, the scoring is in the yes/no format, it is unsatisfactory to base the score on just one of the three possibilities of 'providing the pupils with sufficient details'. One could argue that the teacher has only proven to 'provide the pupils with sufficient details' if each of the three possibilities to do so has occurred at least once; in other words, each of the three possibilities can contribute maximally 1/3 to the total score (being 1) for this theory element. Thus, scoring was done as follows. It was determined for each theory element whether this theory element occurred in the written lesson planning; the maximum score was 1 for every theory element. Some theory elements were, analogous to the scoring of the videotapes, split up into 2 or 3 parts (cf. the example in the previous paragraph). This meant that the

score possibilities on these theory elements not only included 0 or 1, but also .50, .33 or .66. For a complete account of the ways in which the pertinent theory elements were split up into two or three parts, see Appendix VI.
Every teacher's total score for each educational theory was obtained by adding the scores on the separate theory elements, leading to a maximum score of 12 for the Advance Organizer model and 8 for the Role Playing model.

It appeared that there were large differences in total scores between the three experimental groups. For the Advance Organizer model the average total scores for the TT, T and C group were 11.6, 8.2 and 3.3. For the Role Playing model these figures were 6.8, 4.5 and 1.1 respectively. As with the data on stimulated recall and teacher behavior, these differences were nonparametrically tested.
The differences between the three groups were tested simultaneously with the Kruskal-Wallis one-way analysis of variance. For the Advance Organizer model χ^2 was 23.8, which is statistically significant at the .0001 level. χ^2 for the Role Playing model was 19.5, being significant at the .0001 level. As with the stimulated recall and teacher behavior data, the difference between the TT and the T -groups was tested separately (Mann-Whitney U test). These differences were statistically significant for both the Advance Organizer model ($z = -3.57$ $p = .0004$) and the Role Playing model ($z = -2.37$ $p = .0176$).
Thus, it may be concluded that the experimental treatment not only leads to differences in teachers' interactive cognitions and teachers' behaviors, but also in the degree to which the theory elements occur in the lesson plan (research question e3). It should be noted that this conclusion is based on data from a written lesson plan. It is unclear whether the conclusions would be the same when the lesson planning had been investigated more directly and more thoroughly, (for example, by means of thinking aloud protocols). For this reason, the conclusions are drawn with the due restraint.

At the end of the stimulated recall session a questionnaire was administered to all the teachers, inquiring into their lesson planning, the lesson just given and their opinions about the stimulated recall investigation procedure (cf. Appendix VII). The most important question about the lesson planning was of course whether the differences between the experimental groups, reported in the previous paragraph, could be explained by the different amount of effort put into lesson preparation by the three experimental groups. The teachers knew beforehand that the lesson was to be recorded on videotape and would be extensively discussed afterwards. That

they would put somewhat more effort into the lesson preparation than they normally did was seen as inevitable.
Of the teachers 70% reported that they spent a 'more than average' amount of time preparing this lesson. However, there appeared to be no differences between the experimental groups in this respect. For the Advance Organizer model, 8, 8 and 7 teachers in the TT, T and C group, respectively, said that they spent more time than normal on lesson preparation, while for the Role Playing model these data are 7, 6 and 7.
While discussing with fellow teachers the contents of the lesson in advance normally takes place in half of the cases, this was now done in one fourth of the cases. Only 4 (Advance Organizer lessons) and 1 (Role Playing lessons) of the teachers talked with their fellow teachers about the organization and structure of the lesson, while normally this takes place in about 30% of the lessons. These differences may be the result of the fact that normally teachers collaborate with fellow teachers at their probationary schools, coordinating their lessons or working on the same topic, which was not the case in the present study. Whatever the reason may be, on none of the variables mentioned were there significant differences (χ^2) values between the experimental groups.
For the Advance Organizer model 9 of the 10 teachers of the TT group and all teachers of the T group said that they used the text about the educational theory during lesson preparation. For the Role Playing model 9 of the 10 teachers of both groups said that they did so.
Explicitly recalling scenes from the videotape (TT group) was reported by 8 of the 10 teachers for the Advance Organizer model and 9 of the 10 teachers for the Role Playing model.
It can be concluded that on the basis of the questionnaire data, no differences in lesson preparation between the three experimental groups can be determined, apart from the differences that are intrinsic to the treatment itself (e.g., the C group did not have the text of the educational theory at their disposal). Thus, the differences in experimental effects that were discussed earlier in this section cannot be attributed to differences in lesson preparation.

7.5.3 Teachers' educational philosophies

7.5.3.1 Introduction

In the models of teaching 'tradition' a great deal of attention was paid to the relationship between teacher characteristics and the degree to which the teachers were able to master a number of teaching models (Joyce, Brown & Peck, 1981). It may be expected that some teachers are able to master a

wide variety of teaching models, while others are more inclined to cling to a few familiar ones. Apart from that, it may of course be expected that teachers differ with respect to the type of teaching models with which they feel at ease.

The number of teacher variables that can in this respect be taken into consideration is very large. Because the main research question of the present investigation pertains to teacher cognitions, the obvious teacher variables concern teachers' general ideas about teaching and learning, their 'educational philosophies'. It is clear that the teaching models are based on a diversity of ideas about teaching and learning. In the group of models of teaching described by Joyce & Weil, these various 'educational philosophies' roughly correspond to the four 'families' of models: the 'information processing' models, focusing on the transmitting of information that is seen as important within a given culture, the 'social interaction' models, focusing on the development of social skills, the 'personal models' that center on the development of the pupils' personality and the 'behavior modification' models, striving for the development of worthwhile behaviors in pupils. It may be expected that teachers, depending on their own ideas about teaching and learning, feel more or less 'at ease' with a certain family of teaching models. Moreover, it may be expected that this will to a certain extent determine whether the teacher is able to and willing to master a particular teaching model. We will not deal with the discussions about the matching problem in teacher education i.e., the question whether the teacher should be trained mainly in teaching models for which he or she has some 'natural' affinity, or in teaching models for which this is not the case. Within the framework of the present investigation, attention was focused on the expectation that teachers' ideas about teaching and learning may influence their ability and willingness to master the two educational theories, which subsequently manifests itself in the scores on the experimental variables, i.e., the scores on the stimulated recall and the teacher behavior instruments. In particular, it could be expected that those teachers who have an affinity for the ideas that are the basis of the information processing family of teaching models earn relatively higher scores on the experimental variables within the Advance Organizer model, while teachers having an affinity for ideas that are the basis of the social interaction family of teaching models, score relatively higher on the Role Playing model. Thus, it should be determined to what degree the scores on the experimental variables could be explained by the teachers' ideas about teaching and learning, their 'educational philosophies'. This made it necessary to measure teachers' educational philosophies in a way that could be interpreted in terms of the four 'families' of teaching models. In other words, the measurement should indicate with which family or families of teaching models the teacher's

educational philosophy had the strongest similarity. It appeared that an instrument of this kind, the Teaching Style Q-sort (TSQS), had been developed by Heikkinen (1978) for the American situation. His instrument consists of 28 statements about instruction and learning; seven statements were derived from each of the four 'families' of teaching models. Heikkinen reports that in the construction phase of the instrument, independent raters assigned 90% of the statements to the right family (that is, the family they were derived from).

In this study teachers were asked to rank (Q-sort) the 28 statements on the basis of the perceived correspondence to their own teaching style. By adding the scores of the 7 statements that 'belong to' a certain family, every teacher gets a total score for every family of teaching models. Reported test-retest correlations (n = 541) are between .44 for the Information Processing family to .65 for the Behavior Modification family; (all correlations statistically significant at the .01 level). In a factor analysis of the data of 541 respondents, Heikkinen found the four families of teaching models to be clearly discernable in the factor solution, which led him to conclude that with this instrument teachers are able to examine their own teaching style in terms of personal, social interaction, information processing or behavior modification families of teaching models, as described by Joyce & Weil.

The aim of the present part of the study was to determine whether it was possible to employ a translation of this instrument to describe Dutch teachers' educational philosophies in a way that pertains to the four families of teaching models. Thus, apart from the translation, no adaptations were introduced in the instrument. The only difference was that the phrasing of the introductory question focused on teachers' opinions instead of their behavior (cf. section 7.5.3.2).

7.5.3.2 Procedure

The 28 statements of this instrument are given in Table 66. After every statement it is indicated to which family of teaching models it pertains, Information Processing (IP), Personal (P), Social Interaction (SI) or Behavior Modification (BM).

The first version of the translation was screened by two experts on teaching models (both of them were editors of the Dutch version of Joyce & Weil's book 'Models of Teaching'). This led to some modifications in the phrasing of the statements. The Dutch translation of the 28 statements can be found in Appendix VIII.

The instrument was first administered to the 30 teachers of the main study; they completed the form at home. In contrast to Heikkinen's use of the

Table 66 The 28 statements of the Teaching Style Q-Sort

1. Students should have control over the selection of activities so that he/she selects his/her own instructional outcomes (P).
2. Education should emphasize the importance of group problem solving (SI).
3. Concepts are the basis of knowledge (IP).
4. The teacher's task is one of establishing behaviors and then bringing those behaviors under the control of the environment (BM).
5. Instruction should emphasize the maximization of unique personal development (P).
6. The social involvement of group investigation is a route to academic inquiry (SI).
7. Instruction should improve the student's ability to process information (IP).
8. Effective reinforcement should immediately follow a response (BM).
9. The teacher should recognize that the individual is capable of handling his/her own learning in constructive ways (P).
10. The teacher should take a role as a part of the group and be an active inquirer with the students (SI).
11. Students should recognize the tentative and emergent nature of knowledge (IP).
12. The sequence of learning should be broken down into small units to assure success at each step (BM).
13. Teachers should provide environments which are likely to increase the student's capacity to develop himself/herself (P).
14. The school has to be an active participant in the continuing development of culture (SI).
15. The academic disciplines have a structure of concepts which form the information processing system of the discipline IP).
16. Positive and negative reinforcement both can increase response probability (BM).
17. Teachers should keep the students' feelings and problems at the center of the teaching process (P).
18. In a complex, interdependent world, the individual's well-being is closely related to the larger social structure (SI).
19. The task of the school is to identify clear, stable and organized bodies of knowledge within the disciplines (IP).
20. Teachers are able to define all goals and objectives in terms of observable behavior (BM).
21. The student must take responsibility for initiating and maintaining learning activities (P).
22. Instruction should emphasize the relationship of the person to society (SI).
23. Good lectures and demonstrations can lead to meaningful learning (IP).
24. Programmed instruction can be successfully used with any subject area, grade level, and behavior (BM).
25. The teacher must be acceptant of all responses in order to ensure that students feel no external judgments on their creative expression (P).
26. Intellectual operations are learned when students are engaged in active dialogue (SI).
27. The role of the teacher is to retain control of the intellectual structure of the classroom (IP).
28. Behavior modification can be used to extinguish objectionable behavior as well as to establish behavior responses in subject matter areas (BM).

instrument, the teachers were not asked to rate the statements on the basis of their similarity with their own teaching, but on the basis of their similarity with their own ideas about education. This was, of course, directly related to the main purpose of this part of the investigation: depicting teachers' educational philosophies, in order to determine whether they could explain experimental effects. Moreover, it might have been difficult for these prospective teachers, with their inevitably very limited teaching experience, to relate all 28 statements to their own teaching behavior.

The 28 statements were written on separate cards. The teachers were asked

to rate (Q-sort) them on a 7-point scale from 'most disagree' to 'most agree'. The teachers were asked to form seven piles of cards, putting 2 cards in the first pile, 3 cards in the second, 5 in the third, 8 in the fourth, 5 in the fifth, 3 in the sixth and 2 in the seventh. In this way, the values that were assigned to the 28 statements formed a normal distribution. This procedure was identical to the one followed by Heikkinen. The literal (written) instruction for completing the Q-sort was as follows:

> Through this instrument we want to learn something about your ideas on education. The instrument consists of 28 statements about education (printed on separate cards, numbered 1 to 28) and a form (yellow). You are supposed to do the following: Carefully read the 28 statements 3 or 4 times. At every statement ask yourself whether this statement is in agreement with your ideas about education, whether this is, in your opinion, important in education. There will be statements that are quite similar to your own ideas, that you strongly agree with. There will also be statements that you strongly disagree with. However, most of the statements will probably have a middle position: you partly agree with it, you can imagine situations in which you agree but also situations in which you do not agree, etc.
>
> On the form you see a scale, running from '1' to '7'. The '1' means 'most disagree', the '7' means 'most agree' and the numbers 2 to 6 indicate intermediate levels of agreement. Above every number of the scale there are some squares. As you see the squares are not equally divided over the numbers. Above scale-number '1' there are two squares, over scale-number '2' there are three squares, etc. In all there are 28 squares at the form, the same number as the number of separate cards with statements on it.
>
> You are supposed to order the 28 cards in piles, ranging from 'most disagree' to 'most agree', in such a way that in the first pile there will be two cards, in the second pile three cards, etc. When you have finished this, please copy the ordering you made onto the form. You can do this by, for every successive pile of cards, copying the numbers of the statements (which are printed before every statement on the card) onto the form.

The present Q-sort is purposely constructed in such a way that, if with these 28 statements teachers' educational philosophies can be characterized in terms of the four families of teaching models, this structure can afterwards be found in the data, for example, by performing a factor analysis on the resulting data. Kerlinger (1976) terms these type of instruments 'structured Q-sorts', meaning that "in that case we have individuals sort the cards not so much to test the individuals as to test the 'theories' that have been built into the cards". The purpose of the

present part of the study was to determine whether the structure, as defined in the beginning of this paragraph, could be found in the data, whereafter the scores could be used as an alternative explanation of the experimental effects.
Apart from the teachers of the main study, the instrument was also administered to 30 teachers of a second sample. It was deemed particularly necessary to validate the results of the factor analysis (performed to determine the structure of the Q-sort data) with a second sample. The same teachers that functioned as a second sample for completing the Grid ratings of the educational theory program (cf. section 7.4) were taken as the second sample here: 15 teachers from the Leeuwarden secondary teachers' college and 15 teachers from the Nijmegen primary teachers' college. All 60 teachers returned the instrument completely filled out.

7.5.3.3 Results

7.5.3.3.1 Differences between the teachers' colleges

Each teacher's total score was determined on each of the four families of teaching models. There appeared to be some moderate differences between the average total scores found in this study and the ones reported by Heikkinen, based on the data of 541 respondents. (Statistically testing the significance of the differences was not possible because Heikkinen did not report the standard deviations of the average total scores). The average total scores of the two studies are reported in Table 67.

Table 67 Average total scores of the Heikkinen study and of the present study, specified for each 'family' of teaching models.

	Heikkinen study	present study
Personal	30.7	30.8
Social Interaction	28.2	32.2
Information Processing	25.7	25.5
Behavior Modification	27.4	23.5

The averages for the Personal and the Information Processing families of models are almost identical. It appears that the teachers in the Heikkinen study rate the statements of the Behavior Modification family somewhat higher than the teachers of the present study, while for the statements of the Social Interaction family, the opposite is the case. Reflections about

the question whether these differences might have something to do with differences in the related 'educational traditions' of the two countries of course falls outside the scope of this study.

Preliminary to determining the structure in teachers' ratings of the statements, it was investigated whether the four participating teachers' colleges differed as to the overall appraisal of the four families of teaching models. The total averages (and standard deviations) for the four teachers' colleges are presented in Table 68.

Table 68 Average total scores (and standard deviations in parentheses) on the four families of teaching models, specified for the four participating teachers' colleges.

	Personal	Social Interaction	Information Processing	Behavior Modification
Primary Sittard (n = 15)	29.7 (5.5)	32.4 (3.3)	25.4 (3.6)	22.7 (4.3)
Secondary Tilburg (n = 15)	32.7 (5.2)	31.2 (4.8)	24.4 (3.7)	22.9 (4.7)
Primary Nijmegen (n = 15)	31.5 (6.4)	32.7 (3.5)	25.1 (3.8)	24.7 (3.9)
Secondary Leeuwarden (n = 15)	29.5 (4.3)	32.6 (3.2)	27.1 (2.6)	23.7 (4.5)

In order to learn whether the differences between the four teachers' colleges were statistically significant, an analysis of variance was performed for each family of teaching models. The results of these analyses are summarized in Table 69.
It may be concluded that the teachers from the four teachers' colleges that participated in this study did not differ concerning their ideas about the four groups of statements, derived from the four families of teaching models.
The same analyses was done to compare the first (Sittard and Tilburg teachers' colleges) and second (Nijmegen and Leeuwarden teachers' colleges) sample, and to compare the teachers' colleges for primary education

Table 69 Summary statistics of the four analyses of variance on the differences in total average scores of the four teachers' colleges.

	F (df= 3;36)	p
Personal	1.163	.332
Social Interaction	.500	.684
Information Processing	1.587	.203
Behavior Modification	.635	.596

(Sittard and Nijmegen) and secondary education (Tilburg and Leeuwarden). In none of the cases did there appear to be a significant difference on the total average scores on one or more of the families of teaching models.

7.5.3.3.2 Factor analysis on statement scores

In section 7.5.3.1 it was explained that a prerequisite for any use of teachers' educational philosophies as an alternative explanation for experimental effects is the availability of an instrument for expressing teachers' educational philosophies in terms of 'similarity with' the four families of teaching models. Thus, it had to be determined whether in the scores on the set of 28 statements (as derived from the four families of teaching models) there was a structure in which the four families of models could be discerned. For that purpose, a factor analysis was performed on the scores of the 28 statements. It was hypothesized that, analogous to the study by Heikkinen, the four families of teaching models would be discernable in the factor structure.

The factor analysis (principal components) was first performed on the data of the teachers from the main study (Sittard and Tilburg teachers' colleges). It appeared that 8 factors had eigenvalues greater than 1 (accounting for 75.6% of the total variance). Because the hypothesis postulated a maximum of 4 factors, the number of factors was set at 4 (accounting for 53.5% of the total variance). Varimax rotation resulted in the solution presented in Table 70. At each of the 28 statements it is indicated whether it was originally derived from the Personal (P), Information Processing (IP), Social Interaction (SI) of the Behavior Modification (BM) family of teaching models. Only factor loadings > .45 are reported in the table.

Table 70 Results of the factor analysis on the scores of the 28 statements by teachers of the Sittard and Tilburg teachers' colleges.

Statement no.		Factor 1	Factor 2	Factor 3	Factor 4
1	P		-.77		
2	SI				
3	IP	-.72			
4	BM			-.63	
5	P	.65			
6	SI			-.57	
7	IP			.63	
8	BM				
9	P		-.75		
10	SI	.55			
11	IP		.72		
12	BM			.55	
13	P	.53		.56	.48
14	SI	.60			
15	IP				
16	BM				-.70
17	P				.55
18	SI	.54	.53		
19	IP		.55		
20	BM	-.65		-.45	
21	P		-.80		
22	SI	.68			
23	IP	-.61			
24	BM	-.53			
25	P	-.51	-.51		
26	SI			.73	
27	IP		-.49		
28	BM				-.54

From these results it appears that the four separate families of teaching models are certainly not clearly discernable in the factor matrix. (This was also the case when other factor extraction or other rotation methods were used.) The first factor has some distinct characteristics, in the sense that, with the exception of statement 25, all positive loadings are from SI and P statements and all negative loadings are from IP and BM statements. It is striking that half of the statements that load on the second factor are P statements with a negative loading. Factors 3 and 4 are, because of inconsistencies in the results, not interpretable in terms of the four families of teaching models. It appeared that factor solutions with two or three factors did not differ from the four factor solution in this respect.

The same analysis was done on the data of the second sample (Nijmegen and Leeuwarden teachers' colleges). The result of that four factor solution (accounting for 48.2% of the total variance) is presented in Table 71.

Table 71 Results of the factor analysis on the scores of the 28 statements by teachers of the Nijmegen and Leeuwarden teachers' colleges.

Statement no.		Factor 1	Factor 2	Factor 3	Factor 4
1	P	-.68			
2	SI			-.70	
3	IP				.66
4	BM	.49			
5	P		-.68		
6	SI				.56
7	IP		.62		
8	BM	.56			
9	P	-.77			
10	SI	-.47			
11	IP			.64	
12	BM		.53		
13	P			.61	
14	SI		-.51		
15	IP		.64		
16	BM	.72			
17	P		-.79		
18	SI				
19	IP				
20	BM				
21	P	-.76			
22	SI				.67
23	IP			.46	
24	BM				
25	P			-.66	
26	SI		.60		.57
27	IP	.63			
28	BM	.65			

Although compared to the data from the first sample there is an additional factor (factor 4) which seems to represent the SI family, the separate families of teaching families are certainly not clearly recognizable in this factor solution. Factor 1 is again the most consistent in the sense that all positive loadings are from IP and BM statements, while all negative loadings are from SI and P statements.

Summarizing, it may be concluded that the four families of teaching models that formed the basis for the construction of the set of 28 statements

could not be reproduced in the structure of teachers' scores on these 28 statements. Apparently, for the Dutch teachers these groups (families) of statements have too much in common; they are not perceived as four distinct groups.
The results of the factor analysis give no reasons for using teachers' total scores on the four families as alternative explanations for the scores on the experimental variables.

7.5.3.3.3 Homogeneity of subsets of statements

For a further exploration of the structure in the statement scores it was necessary to determine the homogeneity of the subsets of statements that were derived from the families of teaching models. The fact that the total set of statements cannot be split up into four distinct factors, representing the four families of teaching models, does not necessarily imply that a particular subset of statements cannot be sufficiently homogeneous to be a reliable measure of the 'educational philosophy' as represented in the pertinent family of teaching models. Thus, here the overlap between the groups of statements is left out of consideration and attention is focused on the question whether the educational philosophies can be reliably measured with the pertinent subset of statements.
It appeared that the homogeneity of subsets (Cronbach's α) was low: .35, .45, .13 and .55 for the SI, BM, IP and P subsets, respectively. That the homogeneity is relatively low especially for the statements that were derived from the Information Processing models of teaching can be perfectly illustrated from a multidimensional scaling of the statements scores of all 28 statements. The basic non-metric distance model was used, minimizing Kruskal's stress (form 1). The stress of the final configuration in the two-dimensional solution was .22. The final solution is presented in Figure 13. The 28 statements are depicted in two-dimensional space. The 7 statements derived from each of the four different families of teaching models are represented by different symbols. The four groups differ distinctly in the degree to which they are concentrated in a certain region of the total configuration, the IP statements being scattered over the whole figure.
In the interpretation of the low homogeneities it should be kept in mind that the subsets of statements were of a very small size (7). It is clear that increasing the number of items in the subsets will result in a more reliable measuring of the pertinent 'educational philosophies'. Employing the Spearman-Brown formula for increasing the test length indicates that when using subsets with 30 items the reliability (Cronbach's α) of the SI, BM, IP and P subsets would be .73 .80 .43 and .86, respectively. It appears that even after such an increase, the reliability of the IP subset would remain low.

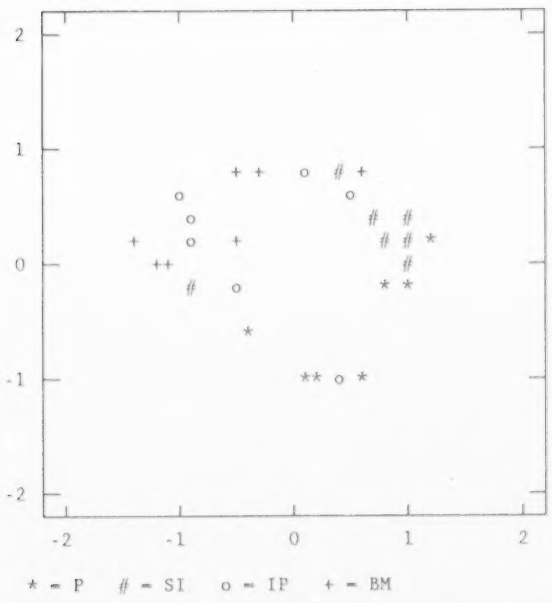

Figure 13 Results of multidimensional scaling of the scores on the 28 statements, the four subsets of statements represented by four different symbols.

In any case it can be concluded that consideration of the homogeneity of the subsets of statements gives no reason for using teachers' scores on the four families of teaching models as alternative explanations for the scores on the experimental variables.

7.5.3.3.4 Clustering the statements

Section 7.5.3.3.2 reported about an attempt to detect underlying dimensions in the teachers' scoring of the 28 statements. It turned out to be impossible to determine factors that were recognizable as 'educational philosophies' in terms of the four families of teaching models. Even if the aim of looking for 'underlying dimensions' is abandoned, it might still be worthwhile to detect some structure in the way teachers scored the 28 statements. The question at issue here is simply whether, on the basis of

the teachers' scores, the statements can be grouped in a meaningful way. This phrasing was specified as follows: if the statements are grouped on the basis of the similarity in their scoring, does the resulting pattern reveal some relationship to the four families of teaching models? The most obvious technique for answering this question is cluster analysis, grouping the statements that were scored analogously as much as possible into the same cluster. A hierarchical cluster analysis was performed on the data of the first sample (Sittard and Tilburg teachers' colleges), using the squared Euclidean distances as the distance measure. The method of 'average linkage' (defining the distance between two clusters as the average of the distances between all pairs of cases) was employed as the clustering method. The results were plotted in a dendrogram, Figure 14. The numbers of the statements are given in the left margin, followed by an indication of the family of teaching models from which that statement was originally derived (P = Personal; IP = Information Processing; SI = Social Interaction; BM = Behavior Modification).

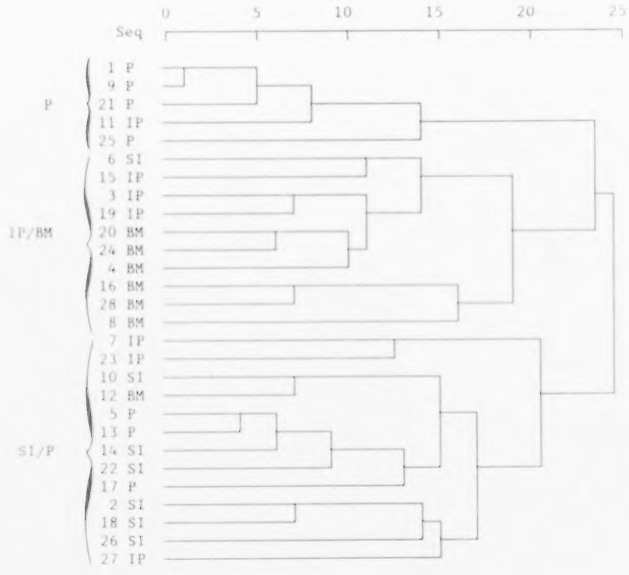

Figure 14 Results (dendrogram) of the cluster analysis on the data of the first sample.

From this figure it appears that there are two large clusters and a small one (as marked by the braces). Except for statement 11, the small cluster at the top of the figure consists, of statements from the Personal family of teaching models. This roughly corresponds to factor 2 from the factor analysis performed on these data (cf. Table 70). The rest of the figure is composed of two large clusters that are of a remarkable composition: the cluster with (from the top) statements 6 to 8 consists almost exclusively of statements from the IP and BM families, while the cluster with the statements 7 to 27 consists (apart from the two IP statements 7 and 23 which were added to this cluster in one of the very last steps of the analysis and, for that reason, definitely can be considered a sub-cluster) almost exclusively of statements from the P and SI families. Much more clearly than the factor analysis, the present analysis reveals that these two pairs of families are scored analogously. It seems that, for the Dutch situation, teachers' 'educational philosophies' should not be expressed in terms of the separate four families of teaching models, but in terms of one of the following two orientations: a focus on either the information processing and behavioral aspects of teaching and learning or the social and personality aspects of it. One could imagine that a teacher in the first category pays relatively more attention to training scholarly abilities, to subject matter issues, to the learning of worthwhile behaviors, etc., while a teacher in the second category pays relatively more attention to the development of the pupils' personalities in the more general sense, to their functioning as group members, etc. Those who are familiar with the heated discussions about the most desirable didactic approach can easily discern the difference between the so-called 'subject matter centered' and the 'pupil centered' approach here. Presumably this distinction is seen, at least by these Dutch teachers, as dominant to such an extent that other distinctions (that no doubt exist within the IP/BM and within the SI/P groups) vanish.

In order to validate the results from the first sample, the same analysis was done on the data of the second sample (Nijmegen and Leeuwarden teachers' colleges). The results are presented in Figure 15.
It appears the pattern discussed above emerges from these data even more plainly than from the data of the first sample. There are two large clusters. The first one, from statement 16 to 11 is, with the exception of statement 18, entirely made up from IP and BM statements. The second one, from statement 2 to 25 consists, with the exception of statement 3, entirely of SI and P statements.

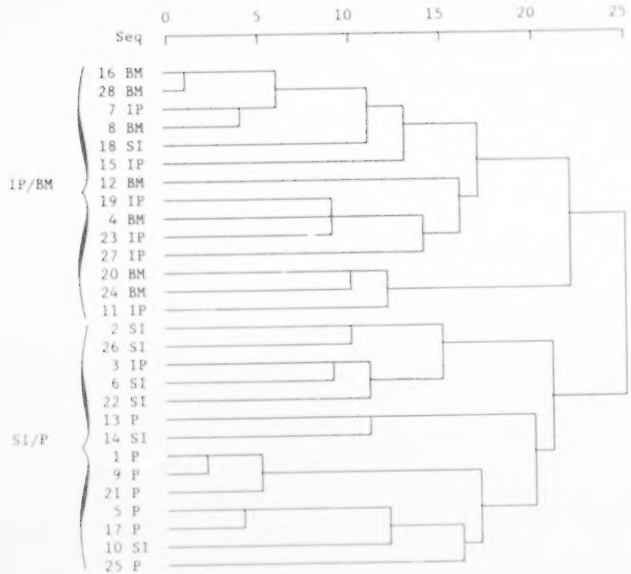

Figure 15 Results (dendrogram) of the cluster analysis on the data of the second sample.

7.5.3.4 Conclusions

The main purpose of measuring teachers' educational philosophies was to determine whether a relationship between preference for a particular educational philosophy and the 'use' (in cognition, behavior or both) of one of the two educational theories could be established. A prerequisite for determining such relationship was that the 'families' of teaching models should be discernable in the data obtained with the instrument for measuring teachers' educational philosophies. From the factor analyses and from the homogeneity data it is evident that this structure does not exist in these data (research question e4; cf. section 6.4). Consequently, investigating the relationship between teachers' educational philosophies and the use of one of the two educational theories (research question e5) is not at order.

The results of the cluster analyses suggest that in teachers' educational philosophies the distinction between 'social interaction plus personal'

families and 'information processing plus behavior modification' families is far more prevalent than the distinctions between the separate families.

7.5.4 Teachers' opinions about the lessons

In this study the 30 teachers were asked to give lessons at their own probationary schools and it was announced that these lessons would be extensively discussed afterwards. For this reason one might expect that, as in other studies of this kind, these lessons would to some extent differ from the 'average' lessons the teachers gave at their probationary schools. To determine to what degree this had, in the teachers' own opinions, been the case, directly after the stimulated recall a number of questions were posed about the lesson just given (cf. Appendix VII). An even more important purpose of these questions was to determine whether there were in this respect any differences between the experimental groups. Given the fact that videotaping the lessons and extensively discussing the lessons afterwards is not an 'ordinary' situation, the question arises whether these particular circumstances might have affected the experimental variables. In this section the results will be discussed at the global level. The teachers did not perceive the lessons as being of better quality than the 'average' lessons. Of the Advance Organizer lessons 3 teachers considered the lesson better than average, 15 teachers the same and 12 considered them of a poorer quality; for the Role Playing lessons these figures were 3, 17 and 10. There were no significant differences between the experimental groups, neither for the Advance Organizer model ($\chi^2 = 2.4$ $p = .66$), nor for the Role Playing model ($\chi^2 = 6.1$ $p = .19$).

Teachers were of the opinion that in general the lessons, compared to the 'average' ones, showed a clearer structure, a series of phases being more readily discernable. For the Advance Organizer lessons 19 teachers were of this opinion, 6 teachers thought there was no difference with the average lessons, while 6 teachers thought that in these lessons the phases were less clearly visible. For the Role Playing lessons these figures were 18, 9 and 3, respectively. There appeared to be no significant differences between the experimental groups in the Advance Organizer model ($\chi^2 = 4.1$ $p = .39$) or in the Role Playing model ($\chi^2 = 3.7$ $p = .45$).

The appropriateness of the topic of the lesson did, in the teachers' opinions, not diverge from the normal situation.

With the Advance Organizer lessons 10 teachers said they were more nervous than normal, 19 teachers said there had been no difference and 1 teacher said there was even been less nervousness (with no significant differences between the experimental groups: $\chi^2 = 3.5$ $p = .47$), while with the Role Playing lessons these figures were 8, 20 and 2, respectively (with also no

differences between the experimental groups: $\chi^2 = 4.9$ $p = .29$).
Pupils' concentration during the Advance Organizer lesson was somewhat higher than normal according to 10 teachers, the same according to 12 teachers and somewhat less than normal according to 8 teachers. For the Role Playing model these figures were 12, 14 and 4. There were no significant differences between the experimental groups, neither for the Advance Organizer model ($\chi^2 = 6.1$ $p = .19$), nor for the Role Playing model ($\chi^2 = 4.6$ $p = .33$).
The teachers' own mastery of the subject matter did not differ from the normal situation.
The teachers were asked to indicate on a 5-point scale, ranging from 'no' (1) to 'yes' (5), whether the pupils had in their opinion been distracted by the camera being present in the classroom. The average score was 2.3 for the Advance Organizer lessons and 2.2 for the Role Playing lessons. Differences between the experimental groups were tested with the Kruskal-Wallis one-way analysis of variance and appeared not to be statistically significant, neither for the Advance Organizer model ($\chi^2 = .86$ $p = .65$), nor for the Role Playing model ($\chi^2 = 3.56$ $p = .17$).
The teachers were asked whether they themselves were distracted by the camera in the classroom. Here the average score for the Advance Organizer lessons was 1.6, while for the Role Playing lessons the average score was 1.3. No significant differences between the experimental groups were present with the Advance Organizer model ($\chi^2 = .49$ $p = .78$) or the Role Playing model ($\chi^2 = .92$ $p = .63$).

The general conclusion is that in the teachers' own opinions these lessons to some degree diverged from the 'average' ones, but that in this respect no statistically significant differences could be found between the experimental groups (research questions e6 and e7; cf. section 6.4). For that reason it may be concluded that these differences did not determine the experimental effects.

7.5.5 Teachers' opinions about the stimulated recall investigation procedure

Because the stimulated recall procedure was very unusual to the teachers, it was considered important to find out teachers' opinions on it. The 30 teachers were questioned about this directly after stimulated recall (cf. Appendix VII). Again the central question concerned the existence of differences between the experimental groups in the way the teachers' had experienced this procedure.
First, five questions were posed that were scored on a 5-point scale,

ranging from 'no' (1) to 'yes' (5). It concerned the questions whether the teachers had learned much from the stimulated recall procedure, whether they had learned more from it than from an 'ordinary' discussion of their lessons, whether the stimulated recall session had lasted too long, whether they were fatigued at the end of the session and whether they were of the opinion that it would be worthwhile to discuss their lessons in this way more often. In Tables 72 and 73 the summary statistics are reported for the Advance Organizer model and the Role Playing model, respectively.

Table 72 Summary statistics of five questions about the stimulated recall procedure (Advance Organizer model)

	M	SD	χ^2	p
Learned much	3.96	.81	.49	.78
Learned more than normally	4.43	1.22	.56	.76
Too long	1.47	.62	.26	.88
Fatigued	2.37	1.25	3.61	.16
More often	4.33	1.03	1.31	.52

Table 73 Summary statistics of five questions about the stimulated recall procedure (Role Playing model)

	M	SD	χ^2	p
Learned much	3.86	1.00	.34	.85
Learned more than normally	4.33	.92	.04	.98
Too long	1.93	1.14	.29	.86
Fatigued	2.90	1.18	1.02	.60
More often	4.10	1.03	.51	.78

The total average is reported in the first column and the standard deviation in the second column. In the third and fourth column the results of the Kruskal-Wallis one-way analysis of variance on the differences between the three experimental groups is reported.

The general view of the teachers on these aspects of the stimulated recall procedure can be termed 'favorable' (research question e8; section 6.4), for both the Advance Organizer and the Role Playing model. On the 5-point scale the average score for 'learned much from the stimulated recall session' is about 4, while 'learned more from it than from ordinary discussion of your lessons' is scored even higher. In line with this is the positive opinion about the desirability of discussing the lessons in this way more often. Although one is somewhat fatigued by the session, its total duration is not considered too long. The most important result of this interrogation is that there are no statistically significant differences between the experimental groups, leading to the conclusion that no effects on the experimental variables existed (research question e9).

In Chapter 4 the validity problems intrinsic to employing the stimulated recall procedure were discussed. In that chapter it was extensively argued why in the present study it was considered justifiable to use stimulated recall and what measures were taken to ensure validity. It was deemed interesting to also ask the teachers themselves some questions about the validity of the stimulated recall procedure, although it was evident that the validity of the procedure could certainly not be based on the answers of the teachers on these questions alone. The answers were considered worthwhile as an unpretentious source of additional information.

Two questions were posed to the teachers about the nature of the stimulated recall information. The first question was introduced as follows: "It is conceivable that during the subsequent discussion of your lesson you remembered certain things that 'went through your head' while you were giving the lesson, but that during that subsequent discussion you in fact did not dare to verbalize that thought completely." The question was phrased as "Did you, during the discussion afterwards, dare to verbalize the interactive thoughts that you remembered?" and was scored on a 4-point scale, ranging from 'almost always' (1) to 'almost never' (4). The average score for the Advance Organizer lessons was 1.20 and for the Role Playing lessons 1.03. For the Advance Organizer lessons the scores for the three experimental groups were the same, for the Role Playing lessons they were very similar (Kruskal-Wallis: $\chi^2 = 2.00$ $p = .37$).

The second, most important, question was introduced as follows: "In the discussion afterwards, you were supposed to report those matters that you had thought during the lesson. However, in many cases it might be difficult to distinguish whether you thought something during the lesson you gave, or you conceived of it only during the discussion of your lesson." The question, scored on the same type of 4-point scale as the previous one, was phrased as follows: "In your opinion, were the thoughts you reported during the discussion afterwards, the thoughts you had during the lesson you gave?" The average score for the Advance Organizer lessons was 1.13 and for

the Role Playing lessons 1.23. From the Kruskal-Wallis one-way analysis of variance it appeared that there were no statistically significant differences between the experimental groups, neither for the Advance Organizer lessons (χ^2 = .56 p = .76), nor for the Role Playing lessons (χ^2 = .36 p = .84).

From the open comments that were solicited upon this question, it appeared that teachers saw the fact that the stimulated recall took place on the basis of the videotape as decisive for the favorable score on this question. They commented in statements like "because I saw myself, I relived the entire situation"; "I was 'there' again and so I could again 'think the thoughts' behind my behavior", etc.

It can be concluded that, in the teachers' opinions, they definitely dared to say what was on their minds during stimulated recall, while they definitely reported those things that they had thought during the lessons. A more extensive discussion of this issue can be found in Chapter 4.

8. DISCUSSION

8.1 Short evaluation of the results

From the results that were discussed in the previous chapter it appears that on the whole this investigation came up to its expectations. Not only because it appeared to be possible to design the treatment in the way we had intended, but also because this treatment led to some degree to the results that were hypothesized. As to these results, the overall differences between the experimental groups, which were statistically significant in the vast majority of the cases, are by no means considered the most important. In view of the fact that the student-teachers from the Control group received no treatment that was specifically aimed at the two educational theories, the overall differences between the experimental groups are not too surprising; the Control group results are regarded as baseline data. Of much more importance are the differences between the TT- and the T-group, which spent the same amount of the time on the two educational theories, but differed in the sense that for the student-teachers from the TT-group working through the video-instrument was part of the treatment. For all theory elements of both educational theories the average score of the TT-group exceeded the average score of the T-group, the differences for the student-teachers' interactive cognitions being larger than for their teaching behavior; the differences for the interactive cognitions were statistically significant for about three-quarters of the theory elements, while for the teaching behavior this was the case for about half of the theory elements. The greater effect on interactive cognitions, compared to teaching behavior, is consistent with the fact that from the beginning the aim of this treatment has been defined in cognitive terms: the materials were intended to contribute to enhancing student-teachers' interpretative abilities, particularly by promoting the incorporation of elements from relevant educational theories into their interactive cognitions (cf. Chapter 2). From the fact that in about three-quarters of the cases a difference between the TT- and the T-group is discernable, it may be concluded that the treatment is suited to accomplish this.

As to the effects on teaching behavior, these effects were investigated for several reasons. In the first place, on the basis of research done in the past on the effects of protocol materials, one might hypothesize that an effect on teaching behavior would exist. Secondly, these kind of effects would be of some importance for the designing of skills training in teacher education programs. Finally, investigating the effects on behavior was necessary to determine the relationship between cognition and action. Although the effects on behavior appeared to be less than the effects on

cognition, the present behavioral outcomes are considered evidence for the effectiveness of this treatment for influencing behavior, in the sense defined in this study. We realize that this claim can be challenged by stressing that for half of the theory elements no significant effects could be discerned.
The same holds for the relationship between teacher thinking and teacher behavior. For about half of the theory elements, the TT- and the T-group differed significantly concerning the proportion of theory-related behaviors that were 'accompanied by' appropriate theory-related cognitions during the same time period. This leads us to conclude that the theory-related actions of the TT-group teachers were relatively more sustained by relevant cognitions. This complies with a characteristic of 'professional behavior' as discussed in the beginning (section 2.1) of this study.
Additional evidence for the effectiveness of the treatment is derived from the fact that for a number of obvious intervening variables no influence could be discerned. This particularly holds for the lack of influence of teachers' appraisal of the educational theory program. The information about the structure of teachers' opinions on the educational theory program (cf. section 7.4) can be considered a by-product of the investigation into the effects of this variable as an intervening one.

8.2 Implications

The findings of this study match with the results of a number of investigations into the effects of protocol materials and of certain components of microteaching, particularly with respect to discrimination training. These matters were extensively discussed in section 2.5 and will not be repeated here. The effects of discrimination training on teaching behavior were also particularly evident in our study. The fact that we also found an even more pronounced effect on cognitions, combined with the fact that the relationship between cognition and action was strongest in the TT-group, suggests that these cognitions functioned as 'mediating' factors for behavior, as defined by, e.g., Peterson (1988) or Gliessman & Pugh (1987).
The results of this study support the ideas about the importance and possibility of influencing teachers' cognitions, as they were discussed in sections 2.5 and 2.6: it appears to be possible to promote the incorporation of elements from educational theories into teachers' cognitive structures that are 'operational' during teaching. It is, moreover, possible to use more or less coherent educational theories for that and to employ the kind of visual instruments that led to behavioral effects in research on the protocol materials. The attainments of the 'cognitive tradition' (Chapter 3) and particularly the elaborated techniques for

investigating teachers' interactive cognitions (Chapter 4) made it possible to determine these effects that were strived for.
Summarizing, it can be said that this investigation supports the evidence that already existed about the possibilities for influencing conceptual variables with regard to teaching, particularly as far as interactive cognitions are concerned.

As to the implications for teacher education, it should be mentioned that of course the materials can be used for just determining whether the student-teachers are able to recognize elements from the educational theories in lesson episodes. Compared to the traditional, verbal evaluation of educational theory, this procedure can be considered 'a move in the right direction'.
Besides, the effects of employing this kind of material, as found in the present study, are of course relevant for teacher education. The changes in teachers' interactive cognitions indicate that these materials induce a more frequent use of theory elements in interactive cognitions. As far as this can be considered a quality of professional activity, these materials are relevant for professional teacher education. The behavioral effects that can be attained with these materials can be regarded to be of substantial importance for teacher education. A decisive argument is that the effects can be attained without complex organizational or programmatic measures on the part of the teachers' college. From previous research we know that the effects of protocol materials were in many cases comparable to particular microteaching-treatments (cf. section 2.5). In the design of the present study no microteaching conditions were included, but in any case it could be observed that the effects were considerable. Microteaching training in these educational theories would no doubt require much more time and effort, both from the teachers' college (in the form of organizational and logistic measures) and from the student-teacher. So, it is advisable to exploit the behavioral effects that can be attained with this kind of material. This does not imply that practice training will be superfluous. At several points in Chapter 2 we mentioned the components that are relevant for the training of teaching skills. Practice training will in any case be necessary for incorporating this kind of skills into one's teaching repertoire (cf. section 8.3); in this respect an important question will be how to overcome the disadvantages of the usual forms of practice teaching (as discussed in section 2.3.1).
In our opinion, in teacher education the potential of this kind of conceptually based material for attaining behavioral goals has been strongly underestimated up to now. The fact that they can be attained without complex measures, and even can be worked through individually by student-

teachers, make them all the more attractive for teacher education. On the basis of our findings we suggest the development of more instruments of this kind in the future.

8.3 Limitations

In this section some limitations of the present study are discussed. For some of them it holds that they are intrinsic to this type of research, for others that they could be overcome in future research. If the latter is the case it will be denoted explicitly.
First some limitations concerning the design of the study will be treated. Subsequently matters concerning the scope and context of the study will be discussed. Finally some remarks pertaining to the character of the treatment will be made.

At several places in this study the small sample size was mentioned. It was indicated that in this study the sample size was substantially larger than the sample sizes that are on the average used in this kind of investigation and that because of the labor-intensive character of the investigation procedure it was impracticable to increase the sample size: in the present study the gathering and coding of the stimulated recall and teaching behavior data took 60 weeks. However, it is clear that, apart from these practical constraints, a larger sample size would be preferable. We cannot present a solution to this problem. If one wants to investigate cognitive processes at the level of the separate cognitions, labor-intensive procedures like this one are inevitable. It might be possible to analyze just a number of segments from every lesson, but it is questionable whether this would lead to a reduction in the effort required; in the kind of analysis we employed, every teacher utterance gets its meaning from the context in which it is embedded and unless the coder has grasped this contextual meaning, he or she is unable to code the utterance correctly. Summarizing, it can be stated that we see this sample size as an important limitation in this study, but we are not able to present obvious procedures for overcoming this limitation in future investigations.
Another limitation in the design of the study concerns the fact that no long term effects were measured. The effects were measured about one month after the treatment had taken place. Compared to other studies on the effects of this type of training materials, the period of one month is rather long. For example, in those studies measuring the effects of microteaching it is not uncommon to do this directly after the microteaching treatment has taken place. Although this one month period can be seen as a reasonable 'compromise' between the measuring of immediate and of long term

effects, the question arises what effects could be discernable after a longer time period. Future research in this area should certainly pay attention to this; it is related to the problem of embedding this type of treatment in the teacher education program, which will be discussed shortly.

In this investigation we covered only two educational theories, as embodied in the two 'models of teaching'. Although two rather dissimilar theories were at issue (which were from two different 'families' of teaching models, as defined by Joyce & Weil, 1980), it is debatable whether the same results would have been obtained if other educational theories would have been chosen. On the basis of the consistency between the results of these two theories (there were practically no significant differences at all between the two theories), we assume that our findings would not be substantially different if other educational theories, meeting the criteria mentioned in section 6.1.1.1, had been used. However, it is advisable to employ other educational theories in future research in this area. The most obvious choice would be from the two other 'families' of teaching models as defined by Joyce & Weil, viz., the 'personal' or the 'behavioral modification' families.

The focus of this investigation was on the effects of a particular type of treatment on cognition and behavior. The treatment pertains to educational theories and the elaboration of this theory in specially designed video materials, which require the student-teacher to perform particular tasks. In our view, this concerns a much underestimated type of training in teacher education. It is clear that a teacher education program will comprise much more than this type of training. In Chapter 2 we determined the place of the component 'educational theory' in the total teacher education program. With our type of treatment only a few steps in the sequence of training in theory-based skills can be covered. A well-known sequence in this kind of skills training is that of theory, demonstration, practice, feedback and coaching, (Joyce & Showers, 1980, 1988). The fact that on the basis of this study we consider the first two components highly underestimated in teacher education (thereby focusing on the practical meaning of 'theory'), does not deny the importance of the other components. This study would have been far more interesting if the practice component of teacher training had also been covered, and particularly if this had included the question in what way incorporating this type of teaching models into the student-teachers' existing teaching repertoires should take place. This would have extended the scale of this study too much. The efforts required for investigating the cognitive and behavioral effects did not permit this extension. However, having determined that the kinds of cognitive and behavioral effects occur, this means that in future studies

it would be preferable to focus attention on procedures for incorporating this kind of material into the teacher education program, on its relative importance compared to other components, et cetera. This should also include the possible function of this type of material in inservice training.

A final remark concerns the character of the treatment. For this type of material it holds that it is identical for all student-teachers who work through it. The only possibility for adapting to the needs and qualities of the individual students is stopping the videotape before it is finished or skipping large parts of it. The compulsory following of the same 'route' through the material by all student-teachers and the impossibility of giving feedback that is tailored to the answers or answer-patterns of individual student-teachers is unsatisfactory and leads to a waste of time and energy. The most adequate solution to these problems would be the development of interactive video materials on these topics. Their capacity to react to the individual teachers' responses and to display exactly those scenes and questions that are appropriate to these responses means an enormous improvement compared to linear video. The permanent evaluation and feedback that could be provided would be of a much higher quality there. One might expect that the effects of linear video that could be discerned in this study would be present to at least the same degree in this type of interactive instrument.

8.4 Final remark

If one considers teacher thinking an important determinant of the events in the classroom, it is obvious that influencing this thinking process can be worthwhile. It seems the more worthwhile if these cognitions can be changed to incorporate key elements of useful educational theories. This study investigated some conditions under which this may or may not take place. Results suggested that teachers are more readily influenced under conditions in which protocol-like materials are involved. Besides, these results suggested that this influence also concerns the teaching behavior. It would be reasonable to develop more materials of this kind (pertaining to other educational theories), so that these materials may partly take over the role of traditional, verbal transmission and evaluation of educational theory in teacher education.

Summary

In this study the effects of a particular type of teacher training material on the cognitions and behaviors of prospective teachers are investigated. It concerns video materials about two educational theories.
The student-teachers studied these educational theories beforehand, concentrating on a limited number of essential elements of the theories. The videotapes consist of a number of lesson episodes in which the educational theories are 'to be seen'. Apart from the lesson episodes, the videotapes also contain commentary and feedback. The student-teacher's task was to recognize the essential theory elements in these lesson episodes. Thus, the video materials can in any case have an evaluative function.
Development of these materials started from the notion that in teacher education the transmittance and evaluation of educational theory should not be done in a purely verbal-theoretical way, but in a such a way that the relationship with classroom behavior is apparent. It is expected that the character of these video materials will not only allow for an evaluative use, but that learning effects will be brought about by using them. In section 6.1. the development and try-out of the materials are extensively described.

The investigation presented here focuses on the learning effects of the video materials. A distinction is made between the effects on the 'interactive cognitions' (i.e., the cognitions of the student-teachers while teaching) and the effects on teaching behavior.
The possible functions educational theory can have for influencing teachers' cognitions and behaviors is extensively discussed in Chapter 2. This discussion is embedded in an evaluation of the role of educational theory in teacher education in general. On the basis of empirical evidence and theoretical considerations the importance of educational theory for influencing cognitions is stressed. Our own research is located within this 'cognitive tradition'. The main function of educational theory in teacher education is seen in its potential for enhancing student-teachers' understanding and interpretation of the teaching-learning process, rather than in its prescriptions for correct or effective teaching behavior. In other words, the most important potential effects of the video materials are of a cognitive nature. Because research on teacher cognitions has, in contrast to research on teacher behavior, no long tradition, there are relatively few validated procedures. The most important problems of research on teachers' cognitions are discussed in Chapter 3. Chapter 4 treats the validity of the technique that was used in this study to elicit the student-teachers' cognitions: stimulated recall.

The investigation is presented in Chapters 5, 6 and 7. There were four main research questions. The first and most important concerned the effects of the use of the video materials on student-teachers' interactive cognitions. The second question concerned the effects of the use of these video materials on the student-teachers' teaching behavior. The relationship between cognition and action was the issue of the third research question. Finally, the possible effects of the student-teachers' appraisal of the educational theory program on the experimental variables was investigated. In Chapter 5 these research questions are discussed at the global level, while a more detailed specification of these questions (and of a number of less essential research questions) can be found in section 6.4.
In order to determine the effects of using the video materials, a comparison was made between a group of student-teachers who worked through the video materials and a group of student-teachers who were confronted with the educational theory in the traditional, verbal-theoretical way. In a control group no specific attention was paid to these two educational theories. Because the investigation of student-teachers interactive cognitions is extremely labor-intensive, the sample had to be small; it contained 30 student-teachers, half of them from the teachers' college for primary education and half of them from the teachers' college for secondary education.

All student-teachers gave two lessons at their own probationary schools. These lessons were recorded on videotape. Immediately thereafter stimulated recall was employed to determine the student-teachers' interactive cognitions. In that procedure the student-teacher used the videotape as an aid to externalize as much as possible of the thought process as it occurred during the lesson. The stimulated recall session was recorded on audiotape. Subsequently it was, with the help of a specially designed category system, determined to what degree the elements of the educational theories could be detected in the student-teachers' interactive cognitions. It appeared that for about three-quarters of the theory elements there were important differences between the student-teachers who had worked through the video materials and the student-teachers who got the verbal-theoretical treatment, in the sense that the theory elements could more often be detected in the video-group.
Possible effects of the treatment on teaching behavior were determined by analyzing the lessons that were given by the student-teachers. Again a specially developed category system was employed. The group with and the group without the video-treatment differed substantially on about half of the theory elements.
In the investigation of the relationship between interactive cognitions and behavior various measuring procedures were employed. It appeared that no

differences between the experimental groups could be discerned when global measures were taken (e.g., determining the correlation between the total scores for each theory element), but that those differences were demonstrable when comparisons were made at the level of the separate cognitions and behaviors: the theory-consistent behavior of student-teachers from the video-group was relatively more often accompanied by interactive cognitions that pertained to the relevant educational theory. The differences were significant for about half of the theory elements.

Because it was conceivable that the student-teachers' appraisal of educational theory was related to the dependent variables, a separate investigation was devoted to this question. It appeared that no effect of this intervening variable could be determined. A 'by-product' of this separate investigation was an understanding of student-teachers' appraisal of the educational theory program. Among other things, it emerged that in this respect the similarity between the various teachers' colleges was high. It also appeared that in the dimensional structure of the ratings four groups of related constructs could be discerned.

In order to find out whether the experimental effects were related to the student-teachers' educational philosophies, a translated version of an instrument was used in which opinions about learning and instruction were linked with four relevant teaching models. Because the required factor structure was not present in our data, this relationship could not be investigated in this way. The statements about learning and teaching could be clustered in a meaningful way.

In the final chapter (8) it is concluded that the differences between the experimental groups are of such a nature that not only can the video instruments have an evaluative function, but also that there is a discernable effect of the video materials on student-teachers' interactive cognitions and behaviors. Development of this type of instrument for other educational theories is advocated. These materials might partly take over the role of traditional, verbal transmission and evaluation of educational theory in teacher education.

Samenvatting

In deze studie wordt een onderzoek beschreven naar de effecten van bepaalde opleidingsmaterialen op de cognities en het lesgedrag van aanstaande onderwijsgevenden. Het gaat daarbij om videomateriaal waarin een tweetal onderwijskundige theorieën is verwerkt.
De aanstaande onderwijsgevenden hebben de onderwijskundige theorieën vooraf bestudeerd en zich daarbij geconcentreerd op een beperkt aantal kernelementen uit deze theorieën. De theorieën hebben betrekking op het klassikaal uitleggen en het geven van een rollenspel. De videobanden bestaan uit series lesfragmenten (afkomstig uit lessen die door aanstaande leraren aan complete brugklassen zijn gegeven), waarin de betreffende onderwijskundige theorieën 'te zien zijn'. Naast de lesfragmenten bevatten de videobanden toelichtend commentaar en feedback. Het is de taak van de aanstaande leraren in deze lesfragmenten de kernelementen uit de betreffende onderwijskundige theorie te herkennen. Het materiaal kan hierdoor in elk geval een evaluatieve functie vervullen.
Aan de ontwikkeling van dit materiaal ligt de opvatting ten grondslag dat overdracht en evaluatie van onderwijskundige theorie op de lerarenopleiding niet alleen op verbaal-theoretische wijze dient te gebeuren, maar op een zodanige manier dat een directe relatie wordt gelegd met concreet lesgedrag. Verwacht wordt dat deze videomaterialen door hun opbouw niet alleen een evaluatieve functie kunnen vervullen, maar dat zij bovendien een leereffect teweeg kunnen brengen. In paragraaf 6.1 wordt een uitgebreide beschrijving gegeven van de wijze waarop dit videomateriaal is ontwikkeld en beproefd.

Het hier gepresenteerde onderzoek is gericht op de leereffecten van deze videomaterialen. Daarbij wordt een onderscheid gemaakt tussen de effecten op de 'interactieve cognities' (dat wil zeggen cognities van de leraren tijdens het lesgeven) en de effecten op het lesgedrag zelf.
De mogelijke functies die onderwijskundige theorie kan vervullen voor het beïnvloeden van cognities en gedragingen van leraren komt uitgebreid aan de orde in hoofdstuk 2. Deze discussie is ingekaderd in een bespreking van de rol van onderwijskundige theorie in de opleiding in het algemeen. Op grond van empirische evidentie en theoretische overwegingen wordt het belang benadrukt van het beïnvloeden van cognities. Het eigen onderzoek wordt gesitueerd binnen deze 'cognitieve traditie'. De functie van onderwijskundige theorie in de opleiding wordt in de eerste plaats gezocht in de mogelijkheden die zij de aanstaande leraar biedt tot een gedifferentieerder waarneming en interpretatie van het onderwijsleerproces en niet zozeer in het leveren van voorschriften voor juist of effectief lesgedrag. Met andere

woorden, de belangrijkste nagestreefde effecten van dit videomateriaal zijn van cognitieve aard.
Aangezien onderzoek naar leerkrachtcognities van betrekkelijk recente datum is zijn hiervoor nog weinig standaardprocedures voorhanden. In hoofdstuk 3 worden de belangrijkste problemen bij het onderzoek naar leerkrachtcognities besproken, terwijl in hoofdstuk 4 ingegaan wordt op de validiteit van de techniek die in dit onderzoek toegepast wordt om de interactieve cognities van de aanstaande leraren te achterhalen: stimulated recall.

In hoofdstuk 5, 6 en 7 wordt het eigen onderzoek gepresenteerd. In dit onderzoek werd geprobeerd een viertal vragen te beantwoorden. Ten eerste werd nagegaan wat het effect was van het gebruik van de ontwikkelde videomaterialen op de interactieve cognities van aanstaande leraren. Aan dit onderdeel werd verreweg de meeste aandacht besteed. Vervolgens werd het effect van het materiaal op het lesgedrag van de aanstaande leraren nagegaan. De derde vraag had betrekking op de relatie tussen cognities en gedragingen. Ten slotte werd onderzocht in welke mate de opvattingen van aanstaande leraren over het onderwijskunde-programma van de opleiding zouden kunnen fungeren als alternatieve verklaring voor eventuele experimentele effecten. In hoofdstuk 5 worden deze onderzoeksvragen op globaal niveau besproken en toegelicht. Een gedetailleerde specificatie van deze vragen (en van een aantal onderzoeksvragen van minder belangrijke aard) is te vinden in paragraaf 6.4. De bevindingen worden gerapporteerd in hoofdstuk 7, waarbij in elk van de paragrafen 7.1 tot en met 7.4 één van de hier genoemde vragen aan de orde komt.

Om het effect van het gebruik van de videomaterialen te kunnen vaststellen werd een vergelijking gemaakt tussen een groep aanstaande leraren die de onderwijskundige theorie in de vorm van deze videomaterialen kreeg aangeboden en een groep die op de klassieke, verbaal-theoretische wijze hiermee werd geconfronteerd. Bij een controlegroep werd geen specifieke aandacht aan de betreffende twee onderwijskundige theorieën geschonken. Omdat het onderzoek naar interactieve cognities bij aanstaande leraren uiterst arbeidsintensief is moest met een kleine steekproef worden gewerkt; er namen 30 aanstaande leraren aan dit onderzoek deel, waarvan de helft afkomstig was van de PABO en de helft van de NLO.

Een maand na de treatment gaven alle aanstaande leraren twee lessen (een uitleg-les en een rollenspel-les) op hun eigen stageschool. Deze lessen werden op video opgenomen. Direct daarna werd getracht door middel van stimulated recall de interactieve cognities van deze leraren in kaart te brengen. Bij een dergelijke procedure fungeert de video-opname als stimulus en probeert de leerkracht zoveel mogelijk van het denkproces dat tijdens de

les is opgetreden te verwoorden. De stimulated recall -sessie werd op geluidsband vastgelegd. Vervolgens werd, met behulp van een daarvoor ontworpen categorieënsysteem, nagegaan in welke mate de kernelementen uit de onderwijskundige theorieën terug te vinden waren in de interactieve cognities van deze leraren. Het bleek dat voor ongeveer driekwart van de kernelementen belangrijke verschillen aantoonbaar waren tussen de groep leraren die het videomateriaal had doorgewerkt en de groep die de 'klassieke' treatment had ondergaan, in die zin dat de kernelementen vaker in de interactieve cognities van de video-groep voorkwamen.
Mogelijke effecten van de treatment op het lesgedrag werden nagegaan door het analyseren van de video-opnames van de lessen die door de leraren waren gegeven. Ook hierbij werd gebruik gemaakt van een speciaal hiervoor ontwikkeld categorieënsysteem. De groep met en de groep zonder video-treatment vertoonden op ongeveer de helft van de kernelementen aanzienlijke verschillen.
In het onderzoek naar het verband tussen interactieve cognities en lesgedrag werden diverse meetprocedures gehanteerd. Het bleek dat er geen verschillen tussen de experimentele groepen aantoonbaar waren wanneer dit verband op globale wijze werd gemeten (bijvoorbeeld door bepaling van de correlaties tussen de totaalscores per kernelement), maar dat dergelijke verschillen wel aantoonbaar waren wanneer op het niveau van de afzonderlijke cognities en gedragingen vergelijkingen werden gemaakt: bij leraren uit de video-groep ging theorie-consistent gedrag relatief vaker gepaard met interactieve cognities die op de betreffende onderwijskundige theorie betrekking hadden. De verschillen waren voor ongeveer de helft van de kernelementen significant.

Omdat de experimentele effecten behalve door de treatment ook bepaald zouden kunnen worden door de waardering die aanstaande leraren voor onderwijskundige theorie als zodanig hebben, werd hieraan een afzonderlijk deelonderzoek gewijd. Hieruit bleek dat deze interveniërende variabele geen invloed had. Dit deelonderzoek leverde als 'bijprodukt' een inzicht op in de wijze waarop aanstaande leraren het onderwijskunde-programma van de lerarenopleiding beoordelen. Hierbij werd onder meer duidelijk dat er in dit opzicht grote overeenstemming bestond tussen de aan dit onderzoek deelnemende lerarenopleidingen en dat in de dimensionele structuur van de beoordelingen een viertal groepen van verwante constructen te onderscheiden waren.

Ten einde vast te stellen of de experimentele effecten samenhingen met de algemene opvattingen van aanstaande leraren over leren en onderwijzen werd geprobeerd een vertaalde versie te hanteren van een in de VS ontwikkeld instrument, waarin opvattingen over leren en onderwijzen gerelateerd worden

aan een viertal, voor ons onderzoek relevante, groepen van onderwijsstrategieën. Omdat in onze data de vereiste factorstructuur niet werd aangetroffen, kon de genoemde samenhang niet op deze wijze onderzocht worden. Wel bleek een zinvolle clustering van de gebruikte uitspraken over leren en onderwijzen mogelijk.

In het slothoofdstuk (8) wordt geconcludeerd dat de verschillen tussen de experimentele groepen van een zodanige aard zijn dat het videomateriaal niet alleen als evaluatiemiddel kan fungeren, maar dat ook gesproken kan worden van een aantoonbare invloed op de cognities en het lesgedrag van aanstaande leraren. Gepleit wordt voor het ontwikkelen van soortgelijke materialen voor andere onderwijskundige theorieën, zodat deze geleidelijk de plaats kunnen innemen van de meer traditionele wijzen van overdracht en evaluatie.

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CURRICULUM VITAE

Nico Verloop (geboren 1949 te Dordrecht) vervulde na zijn Kweekschool-opleiding zijn militaire dienstplicht en was korte tijd werkzaam in het basisonderwijs.
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